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Wm Twining Esq
Ab. 1844



Geographic Distribution
OF
VENOMOUS SERPENTS.



Elaps. 1 *Bungarus.* 2 *Naja.* 3 *Hydrophis.* 4 *Trigonocephalus.* 5 *Crotalus.* 6 *Vipera.* 7

W.H. Lizars. sculp.

41
106

ESSAY

ON THE

PHYSIOGNOMY OF SERPENTS.

BY

H. SCHLEGEL,

DOCTOR IN PHILOSOPHY, CONSERVATOR OF THE MUSEUM OF THE NETHERLANDS, MEMBER OF SEVERAL LEARNED SOCIETIES.

TRANSLATED BY

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PREFACE BY THE TRANSLATOR.

AFTER having read or consulted most of the published works on Ophiology, the Translator never met with any satisfactory system of that branch of Natural History, until he perused the "ESSAY" of M. SCHLEGEL. In the English language certainly there exists nothing of the kind; and scarcely even any descriptions of individuals, worthy of consultation, except the admirable "Indian Serpents" of Dr PATRICK RUSSEL, the observations of Dr JOHN DAVY, in his "Account of Ceylon," and the remarks in Mr A. SMITH'S splendid "Zoology of Southern Africa."

A desire to add to the literature of his country the researches of so accomplished and philosophical an ophiologist as M. SCHLEGEL, and a wish to afford a safe guide to the British Student of Natural History in this department, have produced the present volume.

He would willingly have published a translation of the complete work of M. SCHLEGEL; but the low state of Ophiology in this country deters any bookseller from undertaking so large a work on Serpents,

with such costly illustrations as 421 figures, three separate charts, and two tabular views of their distribution and affinities.

The Translator has therefore restricted himself to the *General* portion of the work ; and has selected from the excellent plates of his Author 24 figures, each illustrative of one of the genera ; to which he has added two figures, for explaining the modern terminology of the *scuta* that defend the heads of Serpents ; and likewise two others, of a remarkable species of *Elaps*, first described by him in Jameson's Edinburgh Philosophical Journal for 1843. The specimen of this Elaps in his own collection, the Translator believed to be unique —as his correspondence with M. SCHLEGEL shews that it was unknown to that great ophiologist : but on lately visiting the large, and now well preserved, zoological collection in the British Museum, he found one other specimen, though mutilated, and without any indication of its native country.

The fear of too much enhancing the price of this volume has prevented the republication of more than one of the Charts—that which shews the Geographical Distribution of the Venomous Snakes.

The Translator has also added, in different parts of the book, a few notes ; which are distinguished from those of his Author by brackets—thus [ ].

The Synoptical Review of Species, in the present publication, will in some measure supply to the Student the want of the more ample *Descriptive Part* of the Original. References are occasionally made, in different parts of this volume, to the *Descriptive Part* of

M. SCHLEGEL'S work, and to illustrations which are not contained in the present publication; but these can produce no ambiguity.

The Translator has added, what he trusts will be found useful, an outline of M. SCHLEGEL'S Arrangement of the Species, with the principal habitat of each individual affixed.

EDINBURGH UNIVERSITY, *December* 1843.

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LETTER

TO

MONSIEUR E. J. TEMMINCK,

CHEVALIER OF THE LION OF THE NETHERLANDS; DIRECTOR OF THE MUSEUM OF THE LOW COUNTRIES; MEMBER OF VARIOUS ACADEMIES AND LEARNED SOCIETIES.

The origin of the work which I now publish, goes back to the first period of my studies; I therefore may regard it as my first effort in natural history. You have granted me the favour of placing your name at the head of my book: this distinguished honour offers me the most suitable opportunity of publicly testifying to you my gratitude, and of shewing to the scientific world how much you have contributed to facilitate my researches, or rather how it is to you that the publication is due. After the departure of our unfortunate friend Boie for India, you had the goodness to confide to my care the extensive collections which include the vertebrate animals, comparative anatomy, and the fossils,—collections forming the finest part of the Museum of the Netherlands. Incited by the example of my learned predecessor, and hoping to be useful to science, by cultivating a branch of zoology hitherto neglected, I di-

rected my researches to the class of Reptiles. I commenced by representing in accurate designs the most interesting species of this little understood class of beings, and it is thus that by degrees was formed a series of anatomical and zoological drawings, one part of which I now publish, and shall cause the rest to follow when the numerous difficulties that at present impede the publication of my researches shall have been wholly removed.

I have abridged in my book all the observations which I have been able to make in Ophiology. Yet, the state in which this part of science exists has constrained me to deviate in many respects from my original plan, and to defer the publication of the anatomical researches, which are the basis of my labours. How could my readers, for instance, have comprehended me if I had spoken to them of the numerous new species, the discovery of which is due to our travellers? How could they explore the way through systems containing such a vast number of species, often purely nominal or more than once introduced? What work could we recommend to serve as a guide through this labyrinth? I do not know any such.

These reasons, joined to several others, have decided me on giving to my book the form under which it now appears. In the mean time, in conceiving this new plan, it presented difficulties similar to those to which I have alluded. To what figures could I refer to complete my descriptions; and how few naturalists can even consult those expensive works in which they are contained? Besides, no study offers more difficulties than the comparison of different species of serpents,—animals which so nearly resemble each other in the form of their bodies, that one is often obliged to have recourse to the structure of the head, to obtain for them distinctive characters.

These motives have induced me to delineate on the same plate the figures of all the species of each genus, or, at least, those of the most remarkable. On comparing these portraits, one will readily be able to seize the peculiar physiognomy of each, and thus to distinguish nearly allied species.

The word Physiognomy is here used in its ordinary ac-

ceptation; it also signifies the total impression which the whole of any being makes on us,—an impression which we may feel, but which it is impossible to express in words: it is the result of the harmony of all the isolated parts, and their mutual relations, which is comprehended at a glance. We retain it as a whole, without being able to give an account of the properties of each of them taken singly. All the existences of Nature, be they animals, plants, or even inanimate objects, make on us this impression; but it is the more difficult to be analyzed, as the beings we examine are more complicated, for the more their nature is elevated, the more do the different characters lose themselves in the harmony of the whole. One of the most essential points of the mark at which the zoologist aims, appears to me to analyze this harmony, and to indicate each characteristic trait in relation to the whole. Yet, our modern methods conduct us in a path precisely opposed to that which I point out. The example of the illustrious author of the *Systèma Naturæ*, falsely interpreted, has even sanctioned the practice of circumscribing the knowledge of beings in general, to such characteristics as are obvious on the first aspect.

In examining a series of living animals, the attentive observer will remark, that, in their features, in their looks, and even in their forms, he may trace the expression of certain dispositions, habits, and passions, which are still more directly than in man the result of organization. On reiterating his observations, he will not fail to recognise by their features the different species of animals; he will seize the relations which link the species to each other; he will bring them together, and in this synthetic process, he will arrive at a natural method. A series of beings thus grouped, will produce an impression of the whole similar to what he would receive from a single individual, —an impression which it is necessary to depict as a whole, to obtain a knowledge of its principal features.

This manner of examining nature is, indeed, diametrically opposed to that which sets out to distinguish individuals from some isolated characters; but, as it offers the only means of tracing a faithful picture of nature, as it sets

free the intellect chained in the narrow bounds of artificial methods, we should early fix the attention of the young naturalist on the universality of these views, and accustom him to seize, at a single glance, all the features which, by their union, form the peculiar character of each individual.

My own attempts, and the example of my predecessors, have proved to me that the artificial method can be employed with less success in the reptiles than in other classes of animals; and that, in following such principles, we shall never be able to give this science that clearness so essential to the beginner. In the publication of my labours, then, I lay down as a rule, to trace, in a few words, a faithful portrait of each species, considered in its different relations to allied species, to indicate the passage of one imaginary group to another, and to reduce the science to its most simple objects: such is the object of my classification. To attain this end, without introducing innovations, I have availed myself, as respects the nomenclature, of the materials which I have found in the works of my predecessors. I hope that philosophers will agree with me in this: for what memory is capable of mastering the nomenclature of even a single class of the animal kingdom, and of making it available in the study of Nature? In what confusion have not modern naturalists plunged the most beautiful of the sciences, by erecting those unintelligible systems, the sole merit of which often resolves itself into a mere parade of words, which dazzle instead of enlightening. Such systems appear to me made only for their authors, and miss their aim, which should be to guide the student, until he be tempted to persuade himself that systems do not exist in nature. Yet these modern artificial methods are not themselves proof against a rigorous examination; they are far from having established what is meant by species and genus. Slight differences of form in some isolated part, due often either to accident or to the influence of different climates, have often induced naturalists to divide a species into sub-species, and to designate each by a special epithet; some of these imaginary species united, form sections which they are pleased to denominate sub-genera, although they are

in fact merely species, &c. To what results must such views lead!

The critical examination of the works of my predecessors has cost me much labour: it was necessarily severe. I have been so; but I have also been impartial. I profess not to understand how several of these works, so difficult to consult, could be useful to the traveller, who, in his quality of general describer, should be able rapidly to familiarize himself with the nature of existences, as a guide to his observations. A book is usually, for the philosopher living in a country town, his sole means of studying the exotic productions of nature; in a word, books also stand him in the stead of collections. My book is only intended to answer this end, or that of communicating my observations to the public, or to those who have not the power of making such for themselves.

You can conceive, sir, that I have encountered great difficulties in the course of my work—difficulties which have their origin either in the nature of the subject, or in the mode in which the science has hitherto been cultivated. The first object of my researches was the rigorous determination of *species*. To attain this end, I was obliged to frame a history of each of them, to study chronologically its synonymy, to make commentaries on iconographic works, in order to prove, by means of the comparison of figures and descriptions, the identity of innumerable nominal species, with some of those which I know to exist. It was principally in devoting myself to this ungracious and fastidious labour, that it was necessary to employ the most rigid criticism. I shall not now enter into further details to discuss the question, whether there exist certain species in nature or not, or if it be necessary to acknowledge the existence of races, &c.; I shall confine myself to a justification of my ideas, when they contradict those of my predecessors.

I purpose to admit into my work no species but what is known in a precise manner. In submitting the species received into the methodical catalogue of existences to a rigorous examination, a great number will be found of uncertain origin; some are established from old specimens

which have lost their colours; others also have been introduced after a superficial examination, and without having been compared with allied species. A few words would have sufficed to characterize them, but very often these diagnostics, or even the detailed descriptions, contain nothing but an enumeration of characters proper to all the species of that genus; so that, after having analyzed and rejected them individually, there does not remain a single distinguishing mark for the species. We may say the same of genera admitted often with similar negligence. According to my opinion, a description which is not comparative, is of no utility. If it be true that a genus represents the assemblage of all the species it includes, it must be allowed, that we can never arrive at a knowledge of the latter but by comparing them with each other, and by stating what is peculiar to each, and common to them all. Assuredly, there will result but little benefit to science by the admission of species, of the whole peculiarities of which we know nothing but the name that has been imposed on them—of species, the multitude of which, continually increasing, confuses our systems. The study of nature consists not in a superficial knowledge of existences, but it views them under the triple aspect of zoology, anatomy, and physical geography. My principal object in publishing my researches being to expose the relations subsisting between animals and the places they inhabit, I have judged it proper to adopt no species of which the country is unknown, except when some conspicuous feature in its structure might render it of real interest for zoology and for physiology.

It is also necessary to use circumspection in consulting the intimations of the native place of animals, as they are given in most works. Few naturalists have the opportunity of obtaining these objects at the first hand; and we can rarely trust to the veracity of mariners, who, often deceived themselves, bring back in their voyages objects of natural history from distant countries which they have visited. The specimens of one colony are sometimes carried to another; they pass through several hands; their origin is forgotten, or they are sent to Europe under the

designation of productions of a country which they never inhabited. I have often had ocular demonstration of mistakes of this nature. Some years ago, one of my friends received a small collection of Javan reptiles from a young planter of Surinam, who pretended to have collected them himself in the vicinity of Paramaribo. I was ready to demonstrate to the new possessor, that Javanese animals, such as the Gecko guttatus, the Elaps furcatus, the Galeotes furcatus, and others, could never at the same time inhabit countries so remote from each other; no faith was attached to my demonstrations. We often have reptiles of the islands of Ceylon and Java addressed to us from the Cape of Good Hope. M. KLINKENBERG of Utrecht possesses a beautiful variety of the Boa Cenchria, which the mariners brought to him as if caught in Java; and this error led the late BOIE to establish a new species of Boa, belonging to the Old World. One of my friends, accepting the offer of an emigrant to the United States to make collections of natural history, furnished him with the means of making the first consignment. This consignment arrived; it contained a collection of the reptiles of the Cape of Good Hope. Among the reptiles brought by M. BLOMHOFF, and described by the late M. BOIE as all natives of Japan, are found species evidently from Java or the adjacent islands, as has been long ago demonstrated by MM. SIEBOLD and BÜRGER. The late M. SPIX has figured among the animals discovered in Brazil, several species collected during his sojourn at Gibraltar, and he has even added notes on their manners, and on the places which they inhabit, &c. I shall say nothing of the work of SEBA, in which most of the indications of the country are inaccurate.

Other difficulties, not less considerable, present themselves in criticising iconographic works. It would seem that their authors have not been always impressed with the aim which a figure should fulfil. According to my views, it should not simply serve to make the animal it represents recognisable, but it should be a substitute for the animal to him who cannot procure it for himself. Now, to answer this end, it is necessary that the figure

should have, in all its parts, a mathematical exactness, so that one could study the relative proportions of the organs it is for the same reason necessary to avoid fore-shortenings as much as possible, and not to confuse the figure by projected shadows. The choice of objects demands equal circumspection: the agony of a violent death often leaves traces in the convulsed features of the face; some parts sustain accidental injuries in putting up the specimens; in others, the organs change their relative positions. This is especially the case with Ophidians, of which the bones of the head are susceptible of very considerable movements. In tracing my figures, I have aimed at avoiding all these obstacles: I have always made use of individuals in a perfect state of preservation, and I have never copied, except from nature. I have followed the same rules in my descriptions; or, when I have not been able to do so, I have expressly indicated it.

The comparative examination of the writings of my predecessors, presented far more difficult obstacles to be surmounted. The principal cause, to which I have frequently alluded, and which appears to have engendered the numerous errors that disfigure our systems, is the multiplication of species and of genera instituted and introduced into systems upon isolated characters. The instances that would justify these remarks are innumerable. Let any one consult my articles Eryx, Naja porphyritica, Boa Cenchria, Python Peronii and P. bivittatus, Acrochordus, Tropidonotus bipunctatus, and T. fasciatus, Crotalus horridus, Vipera Berus, and several others, and he will be convinced that the same species often bears a dozen of names; that it often has been divided into several different genera; that it has even formed the types of different families; that it figures sometimes among the venomous serpents, sometimes among those that are innocuous! Let any one examine the heterogeneous elements out of which some authors have composed their genera Boa, Hurria, Scytale, Elaps, Trimeresurus, and Vipera! In following out such views, it was necessary, in adhering to this principle of classification, to separate the Pythons from the Boas, and to place them in another family; it

was necessary to separate the Hydrophis Colubrina from its congeners, and to arrange the Acrochordus among the Sea Snakes, &c.

You will perceive, in the sequel of my work, that it is absolutely impossible to class Ophidians from such divided and isolated characters. This subject, however, is of too much importance to be thus passed over. I must satisfy myself, by quoting some more examples calculated to defend my ideas against the objections of my adversaries, although I fear that I have already exhausted your patience. All the world allows, that the genus Dryiophis is one of the most natural of the whole order: it may be indicated by distinctive features, taken either from its muzzle drawn out into a tube, or from the superior length of its middle and posterior maxillar teeth; either from the transversely elongated pupil of its eye, or from its green colour, or, lastly, from its smooth scales. But none of these features are, at the same time, applicable to all the species. The fixed essential character of the Najas is an extensible neck; but, in the different species that compose this genus, the faculty of dilating the neck is possessed in all degrees, so that those which recede most from the type, scarcely exhibit traces of this character. Almost all the venomous serpents, properly so called, have carinated scales; but no person would remove from that family the Trigonocephalus Rhodostoma and Tr. nigro-marginatus, because their scales are smooth; no one would reject from the family of Colubriform venomous snakes, of which the scales are generally smooth, the Naja Hæmachates and N. rhombeata, in which the reverse is the case. We observe in the first family a small number of species, the head of which, covered with plates, approximates them to the second family, although in all the other characters they resemble the first. Could one mistake the affinity that exists between the Boa and Acrochordus, although the latter has a compressed tail, and wants the anal hooks? What confusion has arisen from the innumerable individual differences in the disposition of the plates of the head in the Boas and the Pythons! Neither the position of the nostrils, nor the configuration of the frontal plates, nor the presence

nor absence of a grooved tooth, are constant characters in the genus Homalopsis. The late M. Boie has assigned to the Tropidonotus three posterior ocular plates; yet some species among the best characterized depart from the rest, by the absence of this distinctive mark, while it exists among the true Colubri, that present the characteristic indicated by M. Boie. A great number of genera in the division of innocuous serpents, comprising many species, have grooved teeth; whilst the dentary system of the other species is often very uniform.

The order in which I have arranged the species is not arbitrary. On comparing the species of a generic group, we may remark that the characters of the genus may be particularly decided in one of them; which may be termed the typical species of that generic group; but all the rest, though formed on the same type, present modifications more or less conspicuous; some of them may depart from that type, to approximate to a neighbouring group, to which they serve as the transition. I have, in the descriptive part of my work, treated of species in the order I have just indicated. A Synoptic Table, which I have added to my work, will facilitate the review of the species; it will indicate the mutual resemblances that connect them with each other; in a word, it will point out their natural affinities.

I have also added to my work several charts, and a table intended to indicate the distribution of the species of Ophidians over the surface of the globe. The object which I proposed to myself in making them public, is solely to give a general sketch of the geographic distribution of Ophidians; those who wish to be more minutely informed whether such or such a species exist in a particular description, have only to consult the second part of my work, in which they will find the necessary information. I have also treated of this subject in a dissertation, entitled, *An Essay on the Geographic Distribution of Serpents*, which is printed as a sequel to my work. It is unnecessary, Sir, to say to you, that this work has cost me some precious moments. Almost entirely limited to my own researches, from the total deficiency of works furnishing an enumeration of the species of Ophidians of certain

countries, I have been able to find useful notices only in the works of the Prince of NEUWIED, of SPIX, of RUSSEL, and in that published by the Egyptian Commission. We possess, it is true, works, already quoted, that embrace a description of the serpents of certain places; but besides that these works are very few, they are drawn up for the most part in a manner little conformable to the actual state of the science. Some of them offer simply an enumeration of species characterized by a short phrase, or at best are merely a compilation of existing works on ophiology. To make known the productions of a country, it is, in the first place, necessary to amass an ample collection of them, composed of individuals of every age and sex. In disposing of those numerous materials, without troubling one's self about what has been done before, we arrive at a knowledge of the species under all their relations. Before writing the descriptions, it is necessary to compare the species with their congeners, natives of other countries. And, in consulting works already existing, we shall then be enabled easily to unravel the synonymes, and to reject the reduplication of descriptions. It is true, that the composition of such a work is a labour at least of several years, especially when we wish to add notices on the manners and habits—a circumstance, as it appears to me, of prime importance; but should a philosopher take into his consideration the time, when the question regards the utility to science?

I think it necessary to say a few words on the choice of the French language in the composition of my book. The motives which have induced me to this choice are simple, and easy to be guessed; therefore I should have passed over in silence this subject, if grave accusations had not been raised against some of my countrymen, who have acted as I have done. In our days, when all the world is in search of instruction, when the sciences have everywhere acquired popularity, and have so many enlightened amateurs, the man of the world, or well-informed, though not learned persons, to whom the Latin is not familiar, have contributed to the progress of the sciences; assuredly, in these fortunate times, it would be unseasonable to

use a dead language. It then becomes necessary to make choice among the living tongues. The safest course to take was certainly to have written in my mother tongue, the sole language which we can perfectly possess; but of European languages, how few are so universally spread as to be generally understood? I therefore hold myself sufficiently justified, for the reason just assigned, in preferring the French to any other modern tongue; the same reasons make me hope, that my readers will be indulgent in examining my work in a literary point of view.

It only remains for me to indicate the means which have been at my disposal for the composition of my book. It does not belong to me to eulogize our government, the liberal protector of the arts and sciences; every one knows that His Excellency the Minister of the Interior omits no opportunity of promoting the sciences, and that M. Van Rappart also shews himself full of zeal, when there is a question of favouring learning. All Europe knows, by your numerous writings, that the natural sciences have received a no less favourable reception from the government of our Indies. I shall, therefore, say no more, unless to mention the name of His Excellency M. Van Ewyck, governor of the province of Drenthe; a name so dear to science, to all who have witnessed the commencement of our national establishments, and especially to me. It is superfluous to say, that the rich collections deposited in the galleries of the museum of the Netherlands, have served as the basis of my researches; but it is proper to state the origin of those collections, which have enabled me to assign with certainty to each species its true country, and, consequently, to assign constant laws for the geographic distribution of Ophidians. When, in 1820, you conceived, Sir, the project of erecting a National Monument worthy of your country, the collection of serpents consisted of about an hundred specimens, without any indication of their origin, and chiefly brought from the old Academical Cabinet. The numerous contributions sent to the Museum of the Netherlands by MM. Reinwardt, Kuhl, and Van Hasselt—contributions containing the greatest part of the productions of our Colonies

in the East Indies—offered the means of exchanges with the most celebrated collections, and procured for our establishment other objects from countries on which the feet of the Dutch traveller had never yet trodden. Such was the state of the Museum when the late M. Boie quitted Europe in 1825, after having terminated his great work on the Reptiles of Java. This collection, since confided to my care, has extended equally with the other departments of the Museum: it has now tripled its former extent. The great number of travellers, almost simultaneously despatched to various countries of our globe, have especially contributed to procure for us a vast number of objects, perfectly preserved, of which the native region is stated in the most precise terms. Some of our countrymen, established in foreign parts, have been useful to science, by transmitting to our establishment collections containing the productions of their adopted country. Other recent travellers have presented us with duplicates of the produce of their researches,—a circumstance which has no less contributed to render our collections complete, than the purchases made in Paris, in London, and several other capitals. Private individuals also have exerted themselves to communicate to us all objects which could be of any utility for my work.

The small series of Ophidians from New Holland, which makes part of the Museum of the Netherlands, was acquired in London. The voyage of discovery to New Guinea, undertaken in the years 1827 and 1828, by order of our colonial government, has furnished us with a great number of objects of natural history, interesting, and for the most part new. Timor, Amboina, and the other adjacent isles, have been explored at different times by our navigators. A continual residence of those indefatigable naturalists at Java, for nearly twenty years, has contributed to render the productions of the western part of that island almost as well known as those of Europe. My friend Dr Strauss brought me a small collection of reptiles, formed during his sojourn at Manado, at the eastern extremity of Celebes. MM. Von Siebold and Bürger have collected, during their voyage to Japan, a great

number of Ophidians, which, belonging always to similar species, have shewn how well this empire has been explored, as far as regards its natural history. We possess but few serpents from China, Sumatra, Malacca, and in general from the eastern part of Asia. Dr De Witt, established at Bedford, has presented several to us; others have been acquired by our Indian travellers. A package sent in 1827 to the Museum of the Netherlands, contained the spoils of a considerable number of the species described by Russel. The productions of Ceylon are only known to us by the original specimens in several collections in Holland, and a small collection which we owe to the obliging care of Dr Smith, Director of the South-African Museum. M. Lichtenstein has presented to us some species of Ophidians, obtained during the expedition of M. Eversman in Tartary.

The serpents of Europe have been partly communicated by some of our friends, partly by several travellers, or by the Museum of Vienna: we owe to that establishment the serpents of Austria and Hungary; the unfortunate Michaelles sent to us some specimens collected in Spain, and the principal part of those that live in Dalmatia, a country since visited by our traveller M. Francis Cantraine, who, in afterwards exploring Italy, Sardinia, and Sicily, has sent us their productions; M. Roux has presented us with the reptiles of the south of France, and M. Lenz those of central Germany, &c. &c.

The voyage of M. Rüppell has furnished to our Museum most of the productions of Egypt. Colonel Thembert has brought us several snakes taken in the Barbary States, especially in the neighbourhood of Tunis. An intelligent amateur, M. Clifford, the consul of the Netherlands at Tripoli, has investigated, as a naturalist, the environs of that city,—not very rich, it is true, in the productions of natural history. An insalubrious climate, destructive to most Europeans who visit the coast of Guinea, is the cause why so small a number of objects of natural history are brought to us from our colony, established on that land of promise; and it is to Professor Eschricht of Copenhagen that we are indebted for about

thirty serpents, collected in the vicinity of the Danish Fort on the same coast. The southern extremity of Africa has been explored by Dutch naturalists, during a long series of years. MM. KUHL, VAN HASSELT, BOIE, and MACKLOT, touching at Cape Town on their voyage to India, there formed collections. Dr VAN HORSTOK, during his long residence in that town, employed himself in procuring the rarest objects, and has furnished successively to our Museum the materials for a Fauna of that flourishing colony; Drs SMUTS and SMITH also have equally contributed to enrich our galleries with many little-known African serpents.

There are, properly speaking, but two countries of the vast continent of South America which have been zoologically explored; Brazil and Guyana. A part of the specimens procured in the travels of M. NATTERER, in several provinces of the former country, which are deposited in the Museum of Vienna, have been communicated to ours. The Prince of NEUWIED, who visited the eastern coast of Brazil, situated between the 13° and 23° of south latitude, has kindly presented to us duplicates of the reptiles collected by him. These examples were followed by the late M. SPIX, whose travels extended farther to the north, along the banks of the Maragnon, to Bahia. A small series of the ophidians of Brazil, collected by MM. OLFERS, FREIREISS, and BESKE, also form part of the Museum of the Netherlands. Several packages of reptiles from the province of St Paul, have been sent to us from Paris by M. BESKE of Hamburg, and by M. BOIE of Kiel. The beautiful and numerous collections which our establishment owes to the disinterested care of M. DIEPERINK, residing in Paramaribo, have furnished us with the means of making an enumeration of the greatest part of the productions of our colony at Surinam. We are indebted to the Prince of MUSIGNANO, and to Professor TROOST of Nashville, for the reptiles of North America, that form part of our Museum. The first has brought us a considerable number of specimens, natives of the northern provinces of the United States; the latter, settled in the state of Tennessee, has exerted much

zeal in procuring for us the productions of the middle regions of North America.

In my enumeration of the means at my disposal, I have not mentioned the individuals who have furnished me with rare specimens, which it would have been very difficult for me to obtain, or who have generally contributed to render my work as complete as possible. I shall content myself with citing Professors VAN SWINDEREN of Groningen, VROLIK of Amsterdam, VAN DER HOEVEN, and VAN DER BOON-MESCH of Leyden, and Dr HOORN. M. KLINKENBERG of Utrecht placed in my power the numerous rarities of his Museum. The DIRECTOR of the Cabinet of Natural History at Vienna gave me permission to publish the inedited species contained in that Establishment. Dr THIENEMANN of Dresden gave me about twenty figures of serpents, drawn from the life at Surinam, by Dr HERING. Above all, I ought to acknowledge the liberality of Professors FREMERY and LITH DE JEUDE of Utrecht: these philosophers were so obliging as to permit me to select specimens from the valuable collection of Reptiles confided to their care, most of which are natives of Ceylon, the coast of Guinea, North America, &c.

I was about to terminate my work, when, at the end of a long illness, I had the honour, Sir, to accompany you in a journey to Paris, and across a part of Germany. The great number of objects which I saw during this journey, have obliged me to make several additions to my work; additions, however, which would not have been very important, if I had not been permitted to examine, at my leisure, objects in themselves rare, or partly new. I owe this privilege to the extreme politeness of various philosophers who are at the head of scientific establishments: MM. DUVERNOY at Strasburg, and CRETZSCHMAR at Francfort, were anxious to afford me a free use of the collections confided to their care. M. RÜPPELL, whom I have the advantage of acknowledging among my friends, has furnished me with observations on the various reptiles which he had an opportunity of examining in his two voyages; and, lastly, the observations of several amateurs of Paris, among whom I especially mention Dr COCTEAU and M.

AL. LEFEBRE, rendered me important services. It is almost useless to say, that the Museum of Paris offered me the most ample collection. This establishment, during many years the seat of the natural sciences, rivals still, in the number of its specimens, most other collections. All the world flocks to be there instructed; because the friends of science there experience the most liberal reception. I should not speak of this liberality, so often and so justly vaunted, if personal obligations did not demand it as a duty. I had the happiness to be connected for several years with Professors BLAINVILLE and VALENCIENNES; on my arrival in Paris M. DUMERIL also honoured me by his kindness; and I found a frank and sincere friend in M. BIBRON, a zealous and accomplished naturalist, and a rival of my Herpetological labours. All these gentlemen concurred to render my stay in Paris in the highest degree useful; the numerous materials which the Museum of the Jardin des Plantes affords were put at my disposal, and they readily lent me, and allowed me to take to Holland, all the unpublished specimens, or those which I was desirous of submitting to a new examination. I have reviewed, in conjunction with M. BIBRON, at the Jardin des Plantes, the whole of that collection of reptiles; and this inspection led to propositions of exchange, which cannot fail to be very useful to both establishments. Ours has been enriched, by this exchange, with objects from countries with which we have no communication, but which have been visited by French travellers, as Pennsylvania, Carolina, and New Orleans, countries from which MM. LESUEUR MILBERT, BOSC, LECONTE, BARABINO, and others, have brought their productions to the Museum of Paris. The Antilles have been explored by MM. PLÉE, L'HERMINIER, RICORD, POEY, &c.; Cayenne, by LESCHENAULT; Brazil, by LANGSDORF, VAUTHIER, LALANDE, AUG. ST HILAIRE; Paraguay, by D'ORBIGNY: this last traveller has also made a fine collection of the reptiles of Chilé, a country also visited by MM. LESSON and GARNOT, and by GAY. New Holland has afforded several new species, discovered by PERON, LESSON, and especially by QUOY and GAIMARD; others have been collected, in the last expeditions round the world, in New-Guinea, in Waigiou, the Philippines, the Mariannes, and

particularly in the vicinity of Manado in Celebes. The late M. Duvaucel had sent to the Museum of Paris collections from Sumatra; Leschenault, from Java; Diard, from Cochin-China, from Siam, and Bengal. India has been explored by a great many French travellers, among whom we shall only mention MM. Leschenault, Reynaud, and especially M. Dussumier, who has visited almost every point on the coast of Asia, from the Scychelles and Malabar, to the peninsula of Malacca. MM. Goudot and Sganzin discovered several curious Ophidians in Madagascar, a virgin island in respect to natural history. The stay of the late M. Lalande at the Cape, has furnished to the Museum of Paris most of the reptiles peculiar to that colony; M. Perrotet has collected some of those of Senegal; and it is continually receiving them from Barbary since the establishment of a French colony on that coast. The same takes place with the reptiles of Egypt, a country which shares, with Brazil, the first place among those that attract a great number of travellers. The reptiles collected by Olivier in the Levant are still the only known species from Western Asia. M. Bory de St Vincent has very recently made known those of the Morea, and M. Bibron those of Sicily.

The literary means which were at my disposal have greatly aided my researches. Your rich and beautiful collection of books, Sir, has been always open to me; so that I have used it as if my own. Professor Geel, librarian of the University, has kindly put in my power all the books which I required for my work.

The favours with which I have been loaded by M. Reinwardt, demand my most grateful acknowledgments. This venerable philosopher, formerly my most valued preceptor, has communicated to me his manuscripts, and the numerous drawings of animals which he had made in India:* without the aid of his choice library I never could have brought my work to a conclusion. He has aided me by his advice; and I have been fortunate enough, thanks to the friendship with which he has honoured me, to profit often by his knowledge.

* I have commenced the publication of some of them in my *Abbildungen*, of which the first number is about to appear.

I shall not here repeat what I owe to the late H. Boie; my feeble words would not suffice to express the sentiments which I feel in retracing in my memory the moments which the company of this unfortunate philosopher rendered so precious. His mildness, his kindness, and all the qualities of a noble and elevated spirit, made him to be beloved by all who knew him; a philanthropist as zealous as enlightened, he employed his vast erudition only to make it profitable to his friends, and his discoveries were the secret of the whole world. I had the good fortune to enjoy daily intercourse with this excellent man, and I only regret that this intercourse was but of too short duration. Boie wished to confide to me, at his departure, the vast number of observations which have been published by his brother; on arriving in the Indies, he did not cease to communicate to me his notes on the manners and mode of life of Ophidians, which I have taken care to embody in my book. His young pupil and friend, M. Müller, a worthy successor in his labours, has followed so bright an example in communicating to us a great number of drawings executed from the life by our deceased friend, the young Van Oort. Several other friends, among whom I especially reckon MM. St Clair Massiah, Professor Cantraine, and M. Susanna, administrator of the Museum, have sought to assist me by their talents. I offer them my sincere thanks. Lastly, I cannot terminate these pages without returning thanks to the preceptors of my early youth, MM. De Winkler and Professor Schmid of Altenburg in Saxony: if there be any merit in my works, as regards the art of writing, it should be attributed to the second: the first inspired me with that profound taste for the study of Natural History, which decided me afterwards to devote myself wholly to this beautiful science.

I believe I have said all that is necessary for the understanding of my book. Its end will be gained if it obtain your approbation, Sir, and if it be favourably received by that part of the public which prefers simplicity to innovations.

H. Schlegel.

approaching to

OF THE OPHIDIANS IN GENERAL.

It is usual to comprehend under the denomination of Serpents, all those reptiles which, along with a total want of extremities, have a very elongated form of body. A more rigorous examination, however, demonstrates, that among animals which on such principles it would be necessary to class with serpents, some present, in their general organization, peculiarities that separate them in every respect from serpents, to which they bear no resemblance, except in their lengthened forms. It was reserved for our times—thanks to the researches of the anatomist!—to arrange among Batrachians some of those anomalous beings, the greatest part of which have been jumbled together in our systems. In casting a rapid glance over the great series of reptiles whose bodies are covered with scales, we discover that these animals, with the exception of the tortoises, are modelled on two types, familiarly known by the designation of *Saurians* and *Ophidians*. But in comparing these animals with each other, we perceive that the more or less elongated body exists in them in every degree;* that the development of the extremities diminishes in proportion as the species to the second type; that the function of the ribs, as organs of locomotion, augments in the same degree; that species much allied present sometimes great disparities in the arrangement of the extremities, or even are only distinguishable from each other by the want or presence of extremities;† in a word, that the function

* The Scinks, the Seps, the Pygodactylus, the Monodactylus, the Pygopus, the Chalcis, the Tetradactylus, the Ophisaurus, the Pseudopus, &c.

† The Amphisbæna and the Chirotes.

performed in the Saurians by the general form and organs of locomotion, are wholly subordinate to their general organization.* It is thus evident that the characters formed on these parts, must always lead to an *artificial system;* and it is equally clear, from what we shall state, that the two types on which Saurians and Ophidians are modelled, are connected by numerous intermediate forms. Hence many naturalists have refused to adopt the two foregoing divisions, which they have combined into one whole. This mode of viewing the question is equally susceptible of defence or attack; and it is not out of deference to any system that I propose to follow either view. However, as I propose to treat in my book of serpents properly so called, it is necessary to give a definition of the beings I mean to include in this category. It is easy to conceive the idea of a serpent, when we take for the type one of the species in which all the characters of the order are united; but it is difficult to assign the distinctive marks which separate, in a precise manner, the Ophidians from the Saurians.

The characteristics of the animals we denominate Serpents, appear to me to consist in a very elongated body, furnished with a tail, and covered by a defensive armour of hard scales, which moves, supported on its ribs, by means of lateral undulations, which has a form concentrated, in its transverse dimensions, into the smallest

* A comparative examination of specimens has convinced me that the anomalous Saurians, that is, those with elongated forms and rudimentary extremities, always pertain, by their general structure, to some one family of that order, among which they ought to be arranged. It cannot, for example, be denied, that there is a gradual passage from the Scinks to the Anguis and Acontias, through the medium of Scinkus brachypus, S. decreenis, S. serpens, and the Seps, the Pygodactylus, and the Bipes, animals differing from each other less in their structure than in their forms, and composing a single family the Scinkoideans, from which we ought to exclude neither the Ablepharus nor the Gymnophthalmus. The same gradation exists in the family of the Lizards, through the genera Lacerta and Tachydromus to the Monodactylus, and, we may add, as an anomalous species, the Pygopus. We may connect in the classification the Tetradactylus, the Chalcis, the Pseudopus, and Ophisaurus. We come at length to the family of Amphisbænæ, comprehending Chirotes, Leptosternon, Amphisbæna; and that of Typhlops, including Typhlops, Rhinopis, and Uropeltis.

possible volume, but of which the parts are susceptible of an extraordinary enlargement, so as to permit serpents to swallow the large animals intended by nature for their sustenance. Now, to answer this end, the bony case of the heads of serpents does not form, as in the greatest number of the other vertebrata, an immoveable mass; but the component parts are so united together, that all of them, except those enclosing the brain, are susceptible of a greater or less movement, and generally in different directions. This is particularly the case with the bones which, entering into the formation of the lower jaw, give configuration to the head. The development of the *Tympanites*, their mode of attachment, their mobility, which depend on not being fixed to the cranium by their inferior extremities; in short, the structure of the lower jaw, the two branches of which, instead of being united by a symphysis, are banded together by elastic ligaments, and are thus susceptible of considerable separation; these are the circumstances which principally contribute to the enormous enlargement of the mouths of serpents. The total want of feet necessarily implies the absence of certain solid parts, such as the sternum, the pelvis, &c., which unite the limbs to the trunk; the ribs free, and hence enjoying an uniform mobility, contribute to the enlargement of the intestinal cavity, and to that change of the form of the trunk so visible in the different positions of the serpent in running, in swimming, or in climbing. To obey these various movements, the general integuments are divided into numerous compartments, which form so many articulations, parallel to the parts they cover; the scales which form the articulations, on the lower part of the animal, are usually larger than the rest, and perform the office of feet; the ribs are attached to the lateral margin of the internal face of these plates. The naked space of skin between the scales is more considerable than in all other reptiles; and at the throat, this naked skin, in order to accommodate itself to the separation of the jawbones, occurs in the form of a longitudinal fosse, called the *gular fissure*. By this structure of the general integuments, these tunics, contracted in a state of repose, accommodate

themselves to the extraordinary enlargement of the internal parts.

It results from what we have stated on the nature of serpents, that we might exclude from this order the Amphibæna and the Typhlops, although these last are connected in many respects with the Ophidians, and form the transition to these reptiles. It is this approximation which renders it difficult, if not impossible, to establish distinctive characters for the two neighbouring orders of Saurians and Ophidians. Let us illustrate this by some examples. The gular fissure, proper to all Ophidians, except the Acrochordus, is equally seen in several Saurians, such as lizards, &c. Some species of Ophidians shew vestiges of posterior extremities, analogous to those we find in the Apodal saurians, although their structure leads to the belief, that, though the animals last mentioned represent the pelvis, while those of the Ophidians correspond to the posterior extremities. The structure of the tongue in the Varanus (*Monitor*, Cuv.) and Teius (*Sauvegarde*, Cuv.), is scarcely distinguishable from those of Ophidians. The want of eyelids does not afford any distinctive character; for these organs occur in every degree of development in the different species of Saurians. Some species, as the Ablepharus and Gymnophthalmus, are totally without them; the minute eyes of the Amphisbæna, the Typhlops, and the Acontias cœcus, are covered by the general integument, in such a manner that these animals have so low a degree of vision as to be almost blind; the Acontias Meleagris, on the other hand, has its eyes provided with a lower lid; the Pygopus presents a rudiment of a circular eyelid round the whole circumfer ence of the eye, without the power of closing that organ; in several of the Geckos, the eyelids appear as prolongations of the skin, too little developed to serve as a protection to the eyes. One of the most characteristic parts of the cranium of Saurians, is the *columella*, a small pair of linear bones which unite the parietals to the pteregoids. This bone is wanting, however, in the Typhlops, the Amphisbæna, and even in the Acontias. The development of the external ear is found in every shade from the Saurians

to the Ophidians; the last traces appear in the Anguis and Acontias, and totally disappear in the Amphisbæna and the Typhlops. The simple suspensory bones of the jaw, the *tympanites* of serpents, replaced in most of the Saurians by two pieces, are found in the Acontias, although they are wanting in the Amphisbæna and the Typhlops.

The whole bones of the cranium would perhaps furnish better marks of distinction between the two allied orders, if some species of the family of Typhlops, the Uropeltis, did not, in this respect, approach the Ophidians. It is well, however, to obtain an idea of the principal differences which distinguish the skulls of Saurians from those of Serpents. The bones of the face of the latter never form an immoveable mass, perforated by the nostrils, and composed of pieces let into each other; as we observe in Saurians. In Ophidians, the intermaxillary bone of a compressed triangular form, is always free, mobile, and never united to the maxillaries by means of sutures; the latter bones, when they are intimately united to the anterior frontals, present only a narrow attachment, and always possess some degree of mobility; and the lateral edges of the nasal bones are always free through their whole extent. The Pterygoids constantly present themselves in the form of thin, slender bones, rather broad, and joined to the cranium by ligaments, which readily yield to the movements, more or less extensive, which these parts are capable of performing. No Ophidian has a mouth armed with large conical teeth, perpendicularly implanted; the organs in serpents, on the contrary, resemble hooks bent backwards, with sharp points; besides, serpents, with the single exception of the Oligodon, have the palate furnished with teeth like those of the jaws, whilst we find among the Saurians only traces of palatal teeth, in the form of minute irregular asperities.

It may be seen, from all we have said on the structure of Ophidians, that these reptiles are especially remarkable for their mode of locomotion, and the manner of swallowing their prey. These are the circumstances which modify their whole structure: the first determines the general form of their bodies; the second, that of their internal parts. We observe, on examining the general position of their in-

testine, that the same organs which in other vertebrata occupy one or more spacious cavities, are packed in Ophidians, on account of the elongated shape of their trunks, in a long, narrow cylinder. It is obvious that this disposition could not have taken place without great changes in the formation of the viscera, and without disturbing bilateral symmetry. On this account, the heart is sometimes far removed from, at other times approximated to, the head, according to the greater or less capacity of the stomach; for the same reason, we often find but a single lung, sometimes before the heart, but generally placed behind that organ. This lung almost always terminates in a sort of sac, of greater or less size, serving as a reservoir for air. The form of the liver, for the same reason, is modified into a narrow riband, extending from the heart to the pylorus. The gall-bladder, that it might not be impeded in its functions when the stomach is full, is removed from the liver, and is placed in the same curvature of the duodenum which receives the pancreas and the spleen. The stomach resembles a long, not very wide, cylinder. The intestines succeed, the numerous inflections of which are filled with fat, and, after descending in a straight line, terminate in the cloaca. The inferior part of the abdomen, not being sufficiently capacious to receive the other organs, is the cause of the anomalous position of the kidneys, the testicles, and the ovaries; hence, the penis and the secreting organs are lodged in the tail.

It is evident from what we have said, that the form of the greatest part of the internal organs of serpents has no influence on the exercise of their functions; we shall afterwards even see that the position of these organs not only differs in different species, but sometimes varies among individuals of the same species.

The disposition of the external organs, on the contrary, presents more constant forms; but these parts are modified according as the species inhabit trees, the ground, or the water. Locomotion, however, is exercised very uniformly: the same movements make the snake glide on the ground which impel it through the depths of the humid element, or which serve to entwine it around the branches of trees.

The lateral undulations of the body suffice for this sort of locomotion, and it is only the sea-serpents which make use of their tail, expressly fashioned for the purpose, as an oar and a rudder. When the locomotion is performed on a solid body, the ribs, putting in motion the abdominal plates, thus form a series of levers, which maintain the impulsion produced by the undulations of the trunk, in alternately rising and falling, and touching with their anterior extremities the plane of position. The degree of celerity of the locomotion depends, in a great measure, on the nature of the body on which the serpent moves: it draws itself with difficulty over a mirror, or a table with an uniform and polished surface; but it escapes with celerity on sandy ground, or a surface covered with a dry vegetation, as a heath. To climb up perpendicular objects, it knows how to avail itself of every little protuberance which offers a fulcrum to the articulations of its abdomen.

To exercise these functions, it is requisite that the bones composing the trunk of serpents, as well as their muscles, should be properly arranged. Every one, at the first glance, will be struck with the multiplicity and uniformity of these parts. All the vertebræ, all the ribs, are similar to each other, with some exceptions, as regards their shape, and it is only towards the extremities of the animal that these bones diminish in size.

OF THE BONES OF THE TRUNK.

As the vertebræ of the trunk support all the ribs, the usual distinction between cervical, dorsal, and lumbar vertebræ does not hold in serpents; and it follows, that the number of the ribs on each side should always equal that of the vertebræ; and also, that as the scaly abdominal articulations of the skin always correspond to the ribs which are their levers, the number of the plates on the lower surface of the trunk of serpents should equal that of the ribs and vertebræ. Every one knows that their number differs, not only according to the species, but also in individuals, so that sometimes we find in serpents of the same species a difference of 30 or 40 vertebræ, more or less. The number of vertebræ of the trunk, and consequently

that of the pairs of ribs, rarely exceed 300, and are never below 100; the vertebræ of the tail, on the other hand, are sometimes reduced to 5, whilst, in other serpents, they are from 150 to 200.

The conformation of the vertebræ varies equally in the different species, though all are modelled on the same type. We can always distinguish a central part, the body, which is armed with apophyses more or less developed, and more or less numerous, according to the region of the body, or the species. The body of the vertebra is generally compact; but in most tree-serpents the longitudinal diameter of that part considerably exceeds its thickness, so that the bones of the trunk, relatively to the length of these animals, are less numerous than in other Ophidians. The vertebræ play pretty freely on each other, by means of articulations, well defined, and more numerous than in most other animals. The principal junction, which is almost perpendicular to the axis of the vertebra, is composed of a perfectly spherical condyle, divided from the body of the vertebra by a stricture in the form of a neck; this condyle is secured in a hollow, scooped out in the anterior part of the body of the next vertebra; hence results a species of articulation which deserves the name of *Enarthrosis* in its most extensive sense, if these movements were not restrained by the articulations of the *Apophyses* of the vertebræ. The spinous processes, very broad and voluminous at their base, unite behind with the articular apophyses which most generally also replace the transverse processes; at their anterior face, on the contrary, the base of the spinous processes is prolonged in a wide projection, which is lodged in the cavity at the base of the preceding apophyses: the points of union consist of two pairs of lateral articular facets, inclined to the axis of the vertebra, and this is the origin of the supernumerary articular planes in the Ophidians. The planes of the articulating apophyses present a flat surface, in a perfectly horizontal direction. It follows from this description, that the movements of the bodies of serpents can only be freely exercised in the lateral and vertical directions, and yet the movements in

this latter direction are modified by the formation of the spinous processes. It is evident that this mobility must diminish, as the latter have acquired a greater development. In the Boa, the Tortrix, and in several of the genus Coluber, Ophidians which possess the power of strongly rolling up the body, the superior spinous processes are but little developed, and the inferior are only found on the anterior part of the trunk. Other Ophidians, on the contrary, and particularly the serpents properly called venomous, have all the vertebræ bristling with spinous apophyses, both above and below, extremely large, and of which the superior are very broad and locked together. The development of those parts varies even in species of the same genus; but we must defer the particulars to the descriptive part of our book; and I have here only to state that, when the inferior spinous processes exist, generally they are only found on the vertebræ composing the anterior parts of the trunk, reckoning from the heart.

We have stated above that the vertebræ of Ophidians, with a few exceptions, are without transverse processes: the analogous parts occur only in the Bungarus, where they consist of two very slender lamellæ on each side; the superior one little developed, and slightly oblique, the anterior one rather considerable and wide at its extremity.

A bony projection, placed on each side of the anterior part of the body of the vertebræ, and directed a little downwards, supports the articular facet of the *ribs*. These bones, broad and compressed at their base, where they present a small, blunt, apophysis, are almost cylindrical, directed backwards, always arched, but in different degrees in different species; they vary in length according to the circumference of the trunk which they are destined to embrace. The sternal extremity terminates in a cartilage, which is continued on the edges of the abdominal plates.

The external form of serpents indicates that the development of the vertebræ, of their processes, and of the ribs, should diminish towards the two ends of the trunk; and hence the ribs of the first vertebra are very small, or even entirely wanting. The Atlas, often unprovided with a spinous process, has its body perforated by

the odontoid process, which appears in the form of a conical protuberance, surrounded by the three articular planes, which form the glenoid cavity destined to receive the occipital condyle. The small size of the first vertebræ, and the little development of their processes, occasion some obliteration of their articulating surfaces, and even the confounding of one with the other. The vertebræ of the tail exhibit in the arrangement of their apophyses an analogous conformation to those of the trunk; but their size diminishes gradually as they approach the extremity of that member. They are constantly provided with transverse processes directed downwards, which augment in length as they approach the base of the tail, where they are often cleft in two, as are also the last ribs; so that five, six, or more ranges of them may be found. The development of the superior spinous processes of the tail is regulated by that of the apophyses of the vertebra of the trunk; but in sea-serpents they have an uncommon length; the inferior, on the contrary, are always longitudinally cleft, or rather may be considered as a double range. In some Ophidians, as in the Eryx, where the tail is obtuse and thick, the number of the apophyses of the tail is very great; and we see, for the reasons already advanced, in the Bungarus three ranges of transverse processes.

OF THE BONES OF THE HEAD.

The real cranium of Ophidians, or that assemblage of bones which encloses the brain and most of the organs of sense, is the smallest part of the bony frame which serves as a basis for the whole head. On the other hand, the solid organs of mastication, with their appendices and their levers, all fully developed, and all possessing a greater or less degree of movement, compose a larger portion of the head than the former; and on them almost entirely depends the shape of the head. The true cranium is always elongated, and is widest just behind the eyes; from thence the lateral borders most generally converge towards the point of the muzzle; the posterior part of the cranium is suddenly narrowed, and forms a cylindric cavity more

or less drawn out, opened out at the base, dilated in the middle, and thickest towards the extremity. The sides of this part serve for the attachment of the temporal muscles, the action of which, in old animals, produces a projecting crest on the summit of the cranium. The temporal fosse, thus formed, is behind indistinctly bounded by the *tympanites;* before are the posterior frontal bones, which, when they exist, indicate the limits between that cavity and that containing the eye. It is apparent that this cavity will be more or less complete, according to the degree of development of these bones; but this cavity is never entirely closed, except at its anterior part. The nasal cavity too, always open to the front, and with its internal apertures very near the end of the snout, occupies the anterior part of the cranium, and is very imperfectly covered by the nasal bones.

The osseous pieces, composing the walls of the cavity of the cranium, are all firmly united, and consist of the following:—

1. *The sphenoid,* a pairless bone of a lengthened form, occupying the base of the cranium, and provided on each side, in many serpents not venomous, especially in the Boa, with a small protuberance or projection, which serves for the attachment of the internal pterygoid bone; on the other hand, in venomous snakes, properly so called, its posterior part is contracted to a crest, which is often prolonged backwards, to form, in conjunction with the inferior occipital, that long hook analogous to the inferior spinous processes of the vertebræ, and which presents a powerful lever, acting as a point of insertion for the flexor muscles of the head.

2. *The parietal,* also a pairless bone, which chiefly determines the form of the posterior part of the head, of which we have, therefore, already mentioned the form.

3. *The frontals,* properly called, bones always in pairs, which terminate the cranial cavity in front, and descend in the orbits to unite with the sphenoid.

4. *The occipitals,* divided into inferior and superior, indented at the posterior part of the cranium, and fortified by several protuberances, of which those surrounding the oc-

cipital foramen are the largest. The entrance to that cavity is protected above by an osseous plate like a scale, salient and vaulted; below projects the occipital condyle, supported by a neck, and composed of three pieces, which become one by age, forming a single plane, sometimes in the form of a trefoil, sometimes of a heart.

5. We come, finally, to the *temporals*, all around imbedded between the occipitals and the parietals, and containing in their cavities the organs of hearing; the back part contains the pars petrosa.

The assemblage of the *bones of the face* are in the same plane with those that form the bony case of the true cranium; and we shall now describe them. We observe, first, the anterior frontals, a pair of bones usually triangular, which determine the lateral portions of the face, and by their posterior portions assist in forming the anterior part of the orbit; the inferior surface of this bone extends to the maxillary, with which it is articulated in the true venomous snakes; its form and its direction vary exceedingly, according to the functions it has to perform, and its volume is reduced in the latter class of animals to a very small size. Finally, the internal surface composes the back part of the nasal cavity, of which, however, the principal part is formed by several bones attached by ligaments to the cranium, and allowing a certain degree of motion in a vertical direction. The pieces which also form the base of the snout, receive at this anterior end the intermaxillary: They are, 1st, the vomer, composed of two symmetrical pieces, united by their internal faces, broad and triangular before, slender towards the extremity which unites them to the sphenoid; 2d, the nasals, almost always triangular, and with an anterior plate descending to form the septum which divides the nostrils; they cover the nasal cavity; 3d, a small bone analogous to the turbinated bones.

We perceive, moreover, in the skull of Ophidians several supernumerary pieces, which, however, by no means occur in every species. The first are the posterior frontals, bones which descend from the summit of the front to defend the posterior border of the eye. In the Trigonocephalus, the Crotalus, and in some serpents not venomous, we find only

vestiges of these bones ; they disappear in the Tortrix and the Elaps, while they are highly developed in the Boa, in many Vipers, &c. ; but in the Acrochordus they extend to the anterior frontals, and thus replace the supraorbitars, another pair of supernumerary osseous pieces, peculiar to the Pythons, and wedged between the frontals.

All the other bones of the head belong more or less directly to the great apparatus destined for mastication, if such a term may be employed in describing the animals of which we now treat. This apparatus is naturally divided into two parts : the first consists of the upper jaw and its appendages ; the second is formed by the lower jaw, and the pieces which suspend it from the cranium. It is first necessary to describe the *intermaxillary*, a little bone placed transversely at the end of the snout, rarely armed with teeth, the handle of which is lodged between the nasals and the vomer ; being in other points free, it follows the movements of these bones. The *maxillaries*, equally free at their anterior extremity, are united to the cranium, through the medium of the anterior frontals ; their posterior extremity is bound to the external pterygoids ; but it by no means follows that their form and their mode of attachment should always be the same in the different genera of Ophidians. In non-venomous serpents, this bone is pretty long, horizontally placed, armed with a row of numerous teeth, and always united by a bridge more or less wide to the palatal bones, or even to the internal pterygoids. In the poisonous snakes, on the contrary, it is reduced to a very short piece, and always smaller according as the serpent is more poisonous. We observe in the venomous snakes, that this bone only supports the fangs, is articulated only to the anterior frontals, and is free in all the rest of its extent. It is evident, that the development of the external pterygoids, real levers of the upper jaw, should be in the inverse ratio to that of the maxillaries. This piece, intermediate between the maxillaries and the internal pterygoids, is always without teeth, and becomes more slender as it increases in length ; it consequently shews itself in the shape of a linear and very slender stylet in venomous snakes. The internal pterygoids, which unite

anteriorly with the palatals, form with the latter two branches, most frequently in the form of an *S*, extending almost the whole length of the cranium. Their anterior extremity is either free or united to the vomer by ligaments, the posterior end is attached to the internal edge of the tympanite near its base. These bony slips, except in the Oligodon alone, are armed with teeth. Besides its union with the external pterygoid, the internal pterygoid is connected in many non-venomous serpents with the sphenoid. The same is the case with the palatals, which in all that tribe, and in all the true venomous snakes, are attached, by means of a small apophysis, to the base of the cranium.

It remains that I describe the *lower jaw*. Everybody knows that its two branches are joined by a ligament at their anterior extremity, instead of being ankylosed. Each branch is composed of two principal parts, the dentiferous and the articular portions, of which the sutures are covered, on the internal face, by three little supernumerary bones; the superior piece has been compared to the coronoid process in the skeleton of the mammifera; but in many Ophidians, especially in the non-venomous serpents, the portion of which we now speak is almost reduced to nothing, and is placed under the dentiferous part; whilst the true coronoid process is well developed, and occupies the posterior part of the articular portion near its junction with the tympanites. The dentiferous part alone supporting the teeth is always bristled with them throughout its length; it varies considerably in the different species, has acquired the greatest development in the Boa, and is least in the venomous snakes. It is superfluous to remark, that the development of the two principal portions of the lower jaw have an inverse ratio to each other, and that the extent of the whole of that jaw naturally augments with the size of its suspensory bones. These supporting bones occur as a pair on each side: 1st, The mastoid bone, attached to the cranium above the pars petrosa; and, 2d, The *drumsticks* or *tympanitic* bones,* attached to the mastoids by ligaments,

[* The bones are denominated in French *les Caisses*, or *les Tympaniques*. They have no analogy in the skeletons of mammifera, unless we consider them representing the upright angular portion of the lower jaw.]

and having on their inferior extremity an articulating surface more or less grooved, which produces a hinged juncture with the condyle of the lower jaw. The mastoids are rarely firmly united to the skull, as in the Tortrix; more frequently appearing in the form of a scale, are always placed in the same plane with the surface of the cranium, and yield in size to the tympanites; the form and direction of which vary much in the different species; the last-mentioned bones are stout, and suspended nearly perpendicularly in the Elaps, the Boa, the Tortrix, and several other non-venomous serpents; they are slender, filiform, directed outward, and in a position more or less vertical in many Ophidians, especially in the division of the venomous snakes properly so called.

It results from the conformation of these parts, that the mouth of the Ophidians is more susceptible of enlargement, according as the bones which suspend the lower jaw have acquired a greater development, and as those composing the upper jaw are more free. If, on the contrary, as in many Ophidians, these last are bound together and to the skull, if their tympanites are small, the bones acquire a greater solidity or diameter, and the mouth is capable of a less degree of dilatation.

OF THE MUSCLES.

Several naturalists have applied themselves to describe the muscles of Ophidians. Sir EVERARD HOME * has furnished some interesting observations on this subject. We owe to M. HÜBNER,† a physician of Berlin, a dissertation in which the author describes the organs of motion in the Boa Canina; but this academic tract is rarely met with in libraries. MM. DUGÈS ‡ and DUVERNOY § have published descriptions and good figures of the muscles of the head. The researches of MECKEL ‖ on the muscles of

* *Phil. Trs.* 1810; and *Lect. on Comparative Anatomy.*
† *De organis motoriis Boæ Caninæ.*
‡ *Annales de Sc. Nat.* tom. xii.
§ *Ibid*, t. xxvi., pl. 10.
‖ *Vergl. Anat.* vol. iii. p. 130.

the Ophidians, are by far the most complete which have ever appeared on this difficult branch of science. I have dissected the muscles of serpents of many different genera; but these organs have presented in the different species such distinct modifications, that it would require very extensive and comparative researches to reduce all these differences to a common type. Such a labour, more interesting to physiology, would be foreign to the end which I proposed to myself in this work. I shall, therefore, content myself with presenting a superficial view of the muscles of Ophidians in general.

The muscles, especially those of the trunk, are remarkable for the considerable volume observed in some, and the extraordinary size of the tendons, which acquire, in some species, especially in the true venomous snakes, an uncommon development. This organization is requisite to give that force and activity, with which the undulatory movements of the body, the principal means of locomotion in Ophidians, is executed. The muscles of Ophidians being frequently interlaced with each other, it becomes very difficult to give an exact description of each individual muscle; and it is not less difficult to compare those organs with those of animals of a more elevated scale, and to state the modifications they present in departing from their type.

The upper part of the spine, or, if you will, the posterior part, presents a great number of muscles which take their origin from the lateral part of the spinous processes, and which are united to long tendons inserted into the articular apophyses: they form a compound muscle, which corresponds to the spinalis and semi-spinalis muscles of mammifera, and which sends, through its whole length, tendons to the ends of the spinous apophyses; it divides on the neck in two parts, of which the interior is attached to the atlas, while the exterior is prolonged on the occiput, in order to fulfil the functions of levator of the head. The muscles which we are describing unite themselves intimately with the transverse spinous processes which they cover; and this anterior attaches itself to the posterior surface of the occiput. The extensor of the spine is another very considerable muscle, composed of a great

number of bundles of fibres interlacing with each other, and terminating in tendons. These fasciculi proceed from the transverse apophyses, and often send tendons to the spinous apophyses; they are strictly connected with other muscular bundles, which unite the ribs by tens, and are carried forward to the sides of the head. The spaces between the vertebral processes are filled by the spinales and inter-transversales muscles. The muscles of the ribs are numerous and complicated: some are intended to adjust the levers, uniting them in fours; others in a perpendicular direction, are also intended as levators of the ribs; others are seen proceeding equally from the ribs, and descending on the skin of the flanks, even to the abdomen; they cover the fasciculi which are directed obliquely backwards to unite the ribs by twos, and which form posteriorly the flexor of the tail. We distinguish, besides, two or three pairs of intercostal muscles, the external layers of which unite the ribs, sometimes by two and two, at other times by four and four. The interior surface of the ribs, and the inferior surface of the vertebræ, present several well developed muscles, arising partly from the sides of the vertebræ, partly from the ribs themselves, and inserted into the ribs, either at their middle, or at their sternal extremity: these muscles are intended to depress the ribs, and to draw them backwards; they stretch under the tail, forming the flexor of that member; but they are replaced below the neck by the depressors of the head, which have the form of an acute triangle, and are accompanied by the muscles producing the lateral movements of the head.

The head itself has many other muscles which take their origin from the posterior spinous processes of the vertebræ of the neck; one of them extends along the lower jaw, another shorter one passes from the cervical vertebra to the articulation of the jaw. The costo-maxillary muscle extends from the anterior ribs under the throat, to be attached to the branches of the lower jaw, the ends of which are bound together by a little transverse muscle. The muscles of mastication are well developed; the temporal is constantly divided into two parts, of which the anterior

passes below the salivary glands, to be attached, as a broad riband, on the lower jaw; the fibres which are prolonged over the poison gland, and which serve to compress it in the act of biting, proceed also from this muscle. The muscle which stretches from the upper surface of the tympanites has been compared to the Digastric. The muscle passing from the articulation of the lower jaw to the external pterygoids has got its name from this last bone; in venomous snakes it sends off two tendons, one destined for the maxillary bone, the other for the capsule of the fangs. Besides the muscles just described, two others exist, which take their origin near the articulation of the lower jaw: 1st, The internal pterygoids; and, 2d, The muscle which is fixed to the base of the occiput. A third long muscle unites the internal pterygoid to the sphenoid bone, to which it is often attached by two heads. Lastly, there exists a small muscle between the sphenoid and the palatal bones.

OF THE RUDIMENTS OF POSTERIOR EXTREMITIES.

Many serpents have a little hook or spur at each side of the anus, half concealed by the scales, which has been long since recognised; but we owe to Professor MAYER of Bonn, the first accurate account of it. This philosopher has demonstrated, that these organs should be considered as vestiges of *Posterior Extremities*. In the order of Ophidians, these bones have hitherto been detected only in the true Tortrix, the Boas, and the Pythons; all other serpents, according to my observations, are wholly deprived of them. These organs are strongly developed in the Boas; and the size of those animals being favourable to the examination of parts so delicate, the type of the description of these organs is taken from this genus. These vestiges of inferior extremities consist, on each side, of an assemblage of three principal bones, and two small accessory pieces, attached to the articulation of a tibia and a tarsus. The terminal bone, the only one that is externally visible, has the form of a crooked nail, covered with a hard scaly skin. We discover, by means of a longitudinal incision in the muscles at the side of the anus, that

the internal piece, the most developed of all, has more or less the figure of *S*, may be compared to the tibia, and extends with a free end just within the abdominal cavity. The middle piece, on the other hand, which represents the tarsus, is thick, short, a little arched, and is completely concealed in the flesh. The muscles which move this apparatus we are describing, have a very simple structure: the principal are an extensor, with its antagonist a flexor: both are inserted near the upper end of the tibia, and are attached to the tarsus; the extensor on the anterior face near the nail, the flexor at an apophysis placed in the middle of the posterior face of that bone. Two other muscles less marked, suspended from the flesh, and attached to the two little accessory pieces of the tarsus, produce the lateral movement: the adductor, which is directed towards the abdomen, is a good deal less than the abductor, the fibres of which are prolonged on the sides of the back. We find in the Boa, besides these muscles, a second very small flexor, placed at the internal surface of the tibia and tarsus, and contributing to the movements of these two pieces. The apparatus representing the posterior extremities in other serpents provided with them, with some modifications excepted, are precisely on the model of that in the Boa.

We are still ignorant of the use of these vestiges of extremities. Their small size forbids us to suppose that they can contribute to locomotion. It has been stated that they might aid copulation: an opinion to which we can only oppose the fact, that the two sexes are equally provided with them. Other naturalists have maintained that they serve to cling more closely to objects which the wreaths of the tail or of the trunk embrace; and this, perhaps, is the most probable opinion.

OF THE MOVEMENTS.

After having described the organs of locomotion, we shall speak of the divers *movements* which serpents perform. In complete repose, these reptiles love to roll the bodies in a spiral, in such a manner that the head alone,

which is in the centre, is slightly elevated above the other parts; but having the faculty of bending the body in a thousand different positions, they are often found simply extended on the ground with the body undulated in sinuous contours. To produce progression, the serpent has merely to unrol his spires; resting himself afterwards on his tail, rebending his body in successive lateral undulations, and, applying to the ground the numerous points of contact which the anterior extremities of the ribs present, the reptile is pushed forward and transported with a celerity proportional to the efforts or power of the instruments of locomotion. We have already remarked on this head, that the progressive movements of Ophidians are almost all executed in the same manner, and that the tail but aids the locomotion differently, according to the modification which its form undergoes in the different tribes. Very often, in order to observe what passes around them, serpents raise themselves perpendicularly, supporting themselves solely on the tail, or on a part of the abdomen; their trunk is then rigid, and perfectly straight; and most frequently the head is then bent and directed forwards: at other times they bend their bodies as an S, inflating their necks in this position. Suspended perpendicularly from the branch of a tree, the Boa resembles a stiff body without life. In descending from a tree or other tall object, serpents let themselves simply fall to the ground,—their form, and the elasticity of their parts, preventing any dangerous consequences from this fall; on attaining the ground, the shock they sustain, instead of proving hurtful, impels them forward, and serves as a stimulus to their subsequent movements.

Serpents have been repeatedly described, that can perform perfectly a retrograde movement. This peculiarity has been especially attributed to those burrowing snakes that have cylindric bodies, terminated by a tail very thick and obtuse at the extremity; but as this has neither been certified by well-informed travellers, nor by professed naturalists, there is room for doubt on this point; perhaps it owes its origin to the prejudices* of the ancients, who

* Plin. VIII. 35. Ælian, IX. 23.

describe, under the name of Amphisbæna, a serpent furnished with a head at each extremity, and having the faculty of moving in opposite directions. A designation applied to an Ophidian of the Old World, probably the Eryx, is given by modern naturalists, after the example of the Portuguese, to some serpents of America.

The greatest number of non-venomous snakes, and the colubriform venomous serpents, defend themselves against the attacks of their enemies, by darting at them with an elevated head, in order to bite with more effect; some, as the Najas, straighten the front of their bodies, and take a very peculiar position. Most of them hiss strongly, as a prelude to the attack; sometimes also is heard a noise from the air, which they forcibly eject from their nostrils. Several species throw themselves on their prey with huge bounds, seize it generally with the mouth; others secure it by twisting the tail around it; and the Boas also embrace it with the convolutions of their trunk.

The venomous snakes, properly so called, employ the same means to procure the animals on which they subsist, and to rid themselves of their enemies. Indolently extended on the ground, they attack indiscriminately every animal which disturbs them by too near an approach; but knowing the power of their weapons, they are contented to inflict the mortal blow, which but rarely misses its aim. To execute this blow, they generally straighten the head, carry back the anterior part of the trunk, and at a single effort uncoil the folds of their body, and support themselves on the tail; the leap which this movement produces may be compared to the recoil of a spring, and it directs the wound inflicted by the fangs, by a sudden, extremely rapid, downward movement of the head.

OF THE TEETH.

Ophidians swallow the animals on which they live whole, their teeth not serving to chew, nor to break their aliment: they are simple dental organs, destined to inflict wounds,

to detain their prey, and to assist deglutition. Independently of these functions, the teeth often conduct into the wounds, which they make a liquor, secreted by glands lodged in the head. These glands are of two kinds: the one, like the salivary glands of mammals and birds, is composed of numerous small grains, which secrete a fluid similar to saliva, intended to prepare nutritious substances for digestion; the others have a different structure: they form a thick sac, the interior of which is divided into numerous compartments: they distil a liquor which, by the deadly effects it can produce in the animal body, becomes the fatal implement, by means of which serpents kill the animals which serve for their support. The salivary glands are the property of all Ophidians; but scarcely a fourth part of the known species are also provided with the poison glands. The teeth, which conduct the poison into the wounds, are always hollow, and, perforated at both ends, are called *fangs*: these are always placed at the anterior end of the maxillary bone, where they are fixed, and often are its only occupants: concealed in the gums, which here form a sort of sheath, they are recumbent, while the snake is in a state of repose, but are elevated when he intends to bite. The rest of the teeth, and all those of non-venomous serpents, are solid, with the exception of the cavity that contains the nutritive organs of the tooth. It is observed, however, that a considerable number of non-venomous serpents of different genera have jaws provided with one or two teeth larger than the rest, and generally grooved by a canal, extending along their anterior face. These channelled teeth always are found at the posterior part of the maxillary bone; and we but rarely find a second in the middle of the jaws: they have no other function than pouring into the wounds they make a more copious saliva, secreted by the posterior salivary glands, which are most voluminous in the region occupied by those channelled teeth.*

* It is erroneous to class with venomous serpents those snakes which have long and channelled *posterior* teeth. Vague and contradictory accounts of the qualities of Ophidians, furnished by the natives of Java, have probably caused this mistake. In the Indies, as in Brazil, in

In studying the structure of the teeth of Ophidians, we find an insensible passage from solid teeth to fangs. Each tooth consists, in its first stages of development, of a lamella turned up at the sides, so as to be open on its anterior face. In the solid teeth, this fissure is soldered up at a very early age of the animal; it remains open a little longer in the fangs of venomous snakes, properly so called, but at the time of maturity, these fangs only exhibit the two apertures destined for the entrance and emission of the poison, the lower of which always appears as a longitudinal fissure. The other venomous serpents have analogous fangs, but we can always perceive traces of the groove which unite the two orifices for the poison; the channel, then, of the posterior and longest teeth of certain harmless Ophidians, is merely that fissure remaining open

Africa, as in Europe, the inhabitants indiscriminately consider as venomous a great many snakes, especially if their aspect has any thing hideous. M. Reinwardt, during his residence in Java, discovered the existence of grooved teeth in several species of the ancient genus Coluber; when published by the late M. Lichtenault and other travellers, and accompanied by the accounts of the nature of serpents current in that isle, this discovery attracted the attention of European naturalists. Boie has detailed similar observations of Professor Reinwardt on many other Ophidians. I published, in 1827, in a memoir inserted in the Acta Curios. Naturæ of Bonn, my own researches relative to this fact. Since that period, the question has often been discussed, and it has even been concluded on anatomical investigation, that we ought to consider all serpents as dangerous, whose *posterior* teeth were long or grooved. I have arrived by analogous researches, and by a rigorous examination of the accounts which are detailed on the suspicious characters of certain snakes, at a very opposite conclusion. The structure of the supposed posterior venomous gland, so absolutely like the other salivary glands, cannot permit a doubt to remain that it secretes a fluid similar to the ordinary saliva: besides, the recent observations of travellers serve to shew, that the bites, neither of the Driophis nor of the Dipsas, serpents with grooved teeth, produce any fatal effects on man.

The glands of the head of serpents have furnished materials for numerous dissertations, published by Ranby (*Phil. Trans.* N. 401, p. 377,—by Russel, by Seifert, by Tiedemann, *Mem. de l'Acad. de Munich*, 1813, p. 25,—by Cloquet, *Mem. du Mus.*, Vol. VII. p. 62,—by Demoulins, *ap Magendie*, *Journ. de Physique*, IV. p. 274,—by Meckel, *Archiv.* I.,—and by Duvernoy, *Ann. de Sci. Nat.* XXVI. and XXX. We find also remarks relative to this subject in the works of Redi, Mead, Fontana, and Charas.

during the existence of the animal.* Every tooth, before its appearance, is covered by a membrane, which contains also nutritive matter. In ossifying, the tooth fixes its base in the hollow representing the alveoli, and roots itself, as the ossification advances, very often, especially in the fangs; a small orifice at their base remains behind, for the entrance of the vessels and the nerves: thus the fangs are more intimately connected with the bones than the other teeth. We often perceive the germs of new teeth concealed in the germs near the older teeth, and intended to replace the latter when they are accidentally destroyed; soon the new tooth moves to occupy the empty alveolus, where it fixes itself by the development described.† The fangs being more exposed than the other teeth, nature has watched over their reproduction, in placing behind them several germs of new fangs, of which the number is sometimes as high as six, and they succeed in every degree of development; it is not known whether the old fangs are shed spontaneously at certain epochs, and whether this replacing of the fangs is a gradual process. The internal structure of these organs is remarkable, in having the conduit for the poison separated by a partition from the hollow containing the nutrient apparatus of the tooth.‡

The *solid teeth* are found equally in all Ophidians; but their number, their form, and their arrangement, present considerable differences in their various species. With the exception of the Oligodon, which is without palatal teeth, we always reckon four rows of teeth in the upper, and two in the lower jaw. Intermaxillary teeth are only found in the Pythons, and occasionally in the Tortrix scytale: their number is rarely more than four. The solid teeth of Ophidians are most usually all of equal length; but in the Boa they augment in size towards the end of the muzzle; and the reverse occurs in some species of Coluber, Tropidonotus, &c.; the Lycodons exhibit, at the anterior

* See Fig. 1, 2, 3, and 4, Pl. 16, *of my Memoir already quoted.*

† See the Memoir on the Reproduction of the Fangs, published by Rosa, a memoir which I only know by the extract given by Meckel. *Trad. Allem. de l'Anat. Comp. de* Cuvier, t. iii. p. 126.

‡ See the figures of the fangs in the work of Fontana.

extremity of the maxillary bone, several teeth longer than the rest; the teeth of the Dryiophis and Psammophis are very unequal, and we find several very long at the middle of the jaws and at the posterior part of the maxillaries; those teeth, as also the posterior teeth of certain species of the genera Dipsas, Homalopsis, &c., are often grooved, whilst other Ophidians, as the Xenodon, the Coronella, several Homalopsis, &c., have the posterior part of the maxillary furnished with a very large but solid tooth. It is evident that the number of teeth must vary according to the development of the maxillary and the dental bone of the lower jaw. In most of the genus Coluber, each of these branches contain from twenty to twenty-five teeth; those teeth are less numerous in the Homalopsis, the Tortrix, the Calamaria, and are reduced to a very few in the venomous serpents. We have stated above, that the maxillary bone of venomous serpents, properly so called, is only armed with the fangs; but this bone, having a larger development in the colubriform venomous snakes, most frequently carries one or more solid teeth behind the fangs.*

OF THE GLANDS.

The *salivary glands* of serpents present sensible modifications in size, situation, and form, not only in the different genera of this order, but also in different species. Their volume is invariably greater in innocuous species than in those also furnished with a poison gland. The glands are denominated from their position; as nasal, lachrymal, &c.; and we subdivide those about the jaws into maxillary and mandibular. All these salivary glands, although of

* The Tropidonotus rudis presents a very singular anomaly in the presence of points of enamel in the guise of teeth, placed on the extremities of the inferior spinous processes of the seven or eight last vertebræ towards the head. These teeth are directed backwards, and recall those of the Cyprinus and of certain Crustacea; but their use, to judge by their direction, is perhaps analogous to that of the conical appendages of the œsophagus in marine Tortoises. They perforate the tunics of the œsophagus, and shew themselves distinctly in the interior of the canal, even in very young subjects.

one structure, present differences among themselves in aspect and figure. The nasal, for example, is more hard to the touch than those of the jaws; the lachrymal generally exhibits a smooth surface of a paler colour and softer consistence than the rest; and the maxillary glands, when they have a very large posterior lobe, have sometimes that portion subdivided into other lobes, smaller but coherent.

The *lachrymal* gland sends, according to the observation of M. J. Cloquet,* a part of the fluid it secretes into the cavity before the ball of the eye. In this respect it is a true lachrymal gland; but its large size, in some serpents with very small eyes, and the circumstance that the superfluous secretion is poured by several small excretory canals into the mouth, leads to the supposition, that it performs the double office of a lachrymal and salivary gland, and that in some Ophidians it probably merits the latter designation more especially. It is constantly found in all Ophidians; it is placed behind the eye-ball, protected by the posterior frontals when they exist, and is often covered by the temporal muscle; while, in other serpents, it is more or less completely buried in the orbit surrounding the posterior border of the eye.

A *nasal gland* is found in most Ophidians.† When it exists, it occupies the frenal region, and reaches the back of the nostrils. M. Müller has found that it pours its secretion into the mouth by an excretory duct joining that of the lachrymal gland. This gland is very large in the Xenopeltis, in some of the Colubri, and in the Trigonocephalus Rhodostoma.

The salivary glands of the jaws are much less developed in venomous than in innocuous snakes. There are but few species of the latter tribe which have them small, but the Eryx is totally without maxillary glands. The species, on the contrary, with grooved or long posterior maxillary teeth, have always a large gland in that region, which is sometimes more or less separated from the rest of the

* *Mem. du Mus.*, vol. vii. p. 62.

† The learned Professor Müller was the first to discover its existence in Ophidians. See Meckel, *Archiv.*, *Am.* 1829, p. 70.

maxillary gland. In those serpents in which is found, besides the posterior teeth, a long one in the middle of the jaws, the gland, at this point, has also a more considerable volume, in order to supply this large tooth with a more abundant liquor. In many other snakes, the maxillary glands extend under the rostral plate, and unite from both sides, but very often the rostral is divided from the maxillaries. The maxillary and mandibular glands, ranged above the jaws, send into the mouth their secretions by small excretory ducts, opening in the gums at the base of the teeth. The duct of the large gland in serpents with posterior grooved teeth, is very visible, and corresponds exactly with the groove which conducts the saliva into the wound. Very often the maxillary gland is suspended by a tendinous band to the articulation of the lower jaw.

Besides this complicated salivary apparatus, common to all serpents, we find in others a peculiar gland destined to secrete a liquid, which, when introduced into the animal frame, produces effects more or less deadly. This gland, called *poisonous*, because it is the characteristic of venomous snakes, is shut up in very dense tendinous covering, strong and firm to the touch, and ending posteriorly in a narrow slip, which attaches it to the articulation of the lower jaw. Anteriorly, this covering becomes narrow, and ends in a pretty wide duct, extending along the maxillary bone, and descending to terminate in the orifice situate on the anterior face of the base of the fang. In the real venomous snakes, this duct is in folds when the long fangs are recumbent, and has the capability of distension, and of accommodating itself easily to the movements of the maxillary bone. The interior of the venom-gland is divided into a great number of minute compartments or cells, produced by the meeting of their very thin walls at different angles.* It is to this structure alone, totally different from that of the salivary glands, that the secretion of the fluid called *poison* is due, which has got its name from the deleterious effects it is capable of producing in the animal economy. It is true that the bite of the most harmless animals may

* See MÜLLER, *De penitiori Glandularum Structura.*

have dangerous consequences from a concurrence of circumstances, such as the heat of the climate, the mental and pathological state of the animal bitten, the fury which animates the biter, &c.; for the same reason, the bite of serpents not venomous, may become dangerous even to man, when the nature of their saliva has been altered by such circumstances. But the poison of venomous snakes has peculiar deleterious qualities naturally, although the circumstances to which we have alluded may contribute to render it more active.

The *poison*, in its fresh state, is a transparent, limpid fluid, of a greenish-yellow tint, slightly glutinous, though less so than the saliva, to which it has much resemblance; dried, it becomes viscid, and sticks firmly to substances; heated, it evaporates without inflaming; it is diffusible in water, which it renders turbid and whitish when shaken with it. Its properties have considerable affinity to those of mucus; the action of reagents shew it to be neither acid nor alkaline; it has no peculiar smell; applied to the tongue, it produces the same sensation as grease: it may be taken, according to FONTANA,* internally, without the slightest inconvenience being excited; but this observation has been recently contradicted by the experiments of Dr HERING,† made in Surinam, on the nature of the venom of the Crotalus mutus. This traveller, on taking at different times diverse doses of this poison, mingled with water, felt the effects for eight days and more; they manifested themselves by pains in the larynx, and other parts of the body, by a copious secretion of mucus from the nose and œsophagus, by a frequent diarrhœa, accompanied by pains in the rectum, &c.; to these were joined other very remarkable effects, owing to the influence which this poison exercised, according to Dr HERING, on the moral faculties.

It follows from what we have stated, that the venom of snakes produces its deleterious effects only, when, introduced into a wound, it mingles with the blood: these morbid symptoms manifest themselves more terribly and

* This fact was known to the ancients.

† See STAPF, *Archiv.* x. cap. 2. See LENZ, p. 460.

more speedily according as the quantity of the poison has been considerable, and has been introduced into a part of the body abounding in sanguiferous vessels. Hence the reason why the bite of a large species is more dangerous than that of the small, and why a deep puncture, or one in a vein, is almost always mortal, whilst it is often not followed by any bad consequence, where it only reaches hard and callous parts of the body.* We must, however, attribute the greater or less activity of the poison to several other causes than those already cited. Sometimes it is but a single tooth which enters the flesh, at other times both instil their venom; the fangs penetrate with more facility in a slender part of the body, as a finger, than in the thigh or the trunk. Serpents, also, in biting several times, expend their venom, so that the last wounds are less dangerous than the first. We must also take into account the size of the animal bitten, as compared to that of the serpent; in Europe, man rarely perishes from the bite of our viper; it requires from three to four vipers to kill a horse or an ox, whilst a single bite is sufficient to kill in a short time one of the small mammifera. It is not so in tropical countries, where a bite from a large venomous snake has generally fatal effects in man and in other animals. Thus, it may be considered as a law, that the activity of the poison augments with the warmth of the climate; that the bite is more dangerous according to the quantity of the poison instilled into the wound, and according as the animal that inflicted the wound, and its victim, were agitated by violent emotions. Innumerable experiments have been instituted to determine the *degree of activity of the poison* in different species of serpents, and

* The poison has much less effect on cold-blooded animals than on mammals or on birds; on most of the invertebrata it produces no effect whatever. These facts shew that the term poison is not always used in its primitive sense, but rather in a relative sense, and more particularly with relation to the effects which this fluid produces on man or on animals with red blood. This circumstance appears to have given rise to the opinion advanced by some naturalists, that the viper itself, and other animals, as the Anguis fragilis or slow-worm, the buzzard, were proof against the bites of venomous snakes: the alleged facts have never been proved by any positive experiments.

the surest means of arresting their effects. LAURENTIUS acquired celebrity by experiments of this sort; all the world has heard of the six thousand experiments made by FONTANA. The observations of RUSSEL have been introduced into all works of herpetology; Dr DAVY has recently added many new facts, the results of experiments made in the island of Ceylon; M. LENZ has made a great number with the common viper; and a crowd of other naturalists, of physicians, and of chemists, have reported detached facts, serving to elucidate this obscure branch of human knowledge. But notwithstanding the vast number of observations, the results which may be deduced from them are little satisfactory. All tend to demonstrate what we have stated above, viz. that the symptoms following the bites of venomous serpents are infinitely modified by prevalent circumstances. To obtain certain results, it would be requisite to make a vast number of experiments with snakes of the same size, in the same places, at the same temperature, and to cause them to bite animals of the same race, and even of the same constitution; repeating afterwards similar experiments with other species of serpents, we might probably discover, on taking as the result the mean term of the observations, if the nature of the poison differs in the different species of snakes. Without calling in question this hypothesis, propounded by several authors, I have reason to believe, that the bite of venomous serpents, properly so called, is more dangerous than that of the colubriform venomous serpents, and of sea-snakes, because of the power of the weapons with which the first are provided.

The poison of Ophidians affects much less the white-blooded animals than the Vertebrata. In most of the latter, the *effects of the bite* manifest themselves immediately after they are bitten. Man speedily perceives an acute pain in the limb wounded by the fangs, which only make two minute punctures hardly visible, from which a few drops of blood flow: the wounded part afterwards swells, and inflammation declares itself with more or less rapidity; the absorption of the poison is announced by general debility, walking becomes painful, the respiration impeded

and laborious; the patient experiences a burning thirst; nausea and vomiting quickly succeed, often followed by great distress and faintings, which, joined to the most violent pain, deprives the sufferer of his intellectual faculties. Livid spots surrounding the wound are the precursors of gangrene, which spreads to other parts of the body, and causes death after a longer or shorter interval. It is fortunate that the bite of serpents, even in tropical countries, is not always mortal; yet the individuals who have been bitten perceive after their recovery, even through their lives, periodic sufferings, or are affected with partial or complete palsy of the affected parts, or even experience a continual disturbance of their intellectual faculties.

We shall recollect to enumerate, when treating of the errors in which the history of serpents is enveloped, some of the pretended *antidotes* against the bites of snakes: a number of other remedies have been tried, of which the efficacy has been vaunted by some, denied by others, and finally shewn to be useless by subsequent experiments. Every country produces persons who pretend to possess the art of curing the bites of serpents; but we should distrust superstitious persons, most frequently impostors, whose whole knowledge is founded on empiricism. Every tribe of the numerous races of men of both Americas have a different mode of treating maladies of this nature; but the plants of which the one tribe vaunts the virtues, are unknown or rejected by the rest. In the villages of central Europe it is chiefly herdsmen and shepherds who, professing the healing art, consider it nothing above their skill to cure the bites of vipers. In India and in Egypt this art is the special occupation of one caste, at this day as ignorant as were their ancestors in classic times. Instead of transcribing here what has been written on this subject, I shall confine myself to point out the remedies which have been most successfully employed and generally recognised.

The first *precaution to use*, when one has been bitten by a venomous serpent, is to clean the bitten part, in order to prevent the poison adhering to the skin from entering the scarifications, which it is judicious to make immediately:

we may either employ caustic or the cautery to destroy the flesh in that part. After having again washed the wound, let it be pressed, and strive to prevent the absorption of the poison, by sucking the part, or, what is preferable, employing the cupping-glass. A ligature over the wound itself, and another tied above the wound, if its form will permit, to prevent the communication of the poison to other parts of the system, has been acknowledged to be of essential service, provided they be not too tightly drawn. We need not mention the various internal remedies that have been administered, except sudorifics, which have been stated to have good effects. M. Lenz* has successfully employed chlorine, and recommended both its internal and external use; one may take daily, without inconvenience, an ounce or more of this chemical preparation. Frictions made with good olive oil have been recognised as efficacious in several instances. Some naturalists ascribe to ammonia qualities which others deny to it: it is the same with arsenic, and many other remedies, which should only be employed with caution, and after having administered ineffectually those which we have already mentioned.†

OF THE TONGUE.

The *tongue* of Ophidians is peculiarly remarkable, from its great extensibility. Covered by very firm tunics, weak, slender, and divided at its point into two filaments more or less fine, it can be retracted within a sheath, the mouth of which opens at a short distance before the glottis. The position of this organ differs in each species. In the Hydrophis, for example, they lie near the point of the snout, whilst they are placed farther back in terrestrial and tree snakes. The tongue of Ophidians, although perfectly similar to that of certain Saurians, as the Monitors and the Tejus, &c. is distinguished by the great simplicity of the hard parts which support it; in fact, in-

* P. 246.

† Consult, besides, the dissertations already cited, the *Toxicology of Orfila*.

stead of an *os hyoides*, composed of several pieces, we find a simple cartilaginous film attached to the internal surface of the general integuments of the gular region, of which the two ends are prolonged far back. This cartilage is sometimes, as in the Boa, intimately united to the muscles of the throat, the fibres of which it divides, its posterior extremity being attached afterwards to the skin on the sides of the neck; but in the greatest number of other Ophidians, the horns of the hyoid bone are free, very approximate, and prolonged into the cavity of the chest, sometimes even to the heart itself. Each of these horns is accompanied by a cylindrical muscle of the same extent united to their posterior ends; these muscles, the antagonists of the genio-hyoids, retract the tongue within the sheath. The tongue, by its construction, is a true organ of touch, and can neither serve as an organ of taste, nor participate in deglutition, since it remains within its sheath during that operation. A small aperture at the point of the muzzle with which most serpents, except the water-snakes, are provided, serves as an opening by which these animals can dart out the tongue without opening their mouths; this is generally performed slowly, and it is only when they are enraged that they dart out the tongue with velocity.*

OF THE INTESTINES.

The *alimentary canal* of Ophidians† is remarkable for its great simplicity. The œsophagus and the stomach, forming but one continuous canal, it is impossible to assign precise limits to each of these organs. The canal descends quite straight behind the heart, and insensibly enlarging it terminates in a pouch more or less capacious; turning afterwards to the right, it abruptly contracts to form, as it narrows, a little sac, at the termination of which is the valve of the pylorus, more or less distinct according to the species. The *intestinal canal* usually oc-

* See HELMANN *Ueber den Tastsinn der Sehlangen.*

† For a description of the organs of digestion, see the Memoirs of DUVERNOY, *Ann. de Sciences Nat.*; and MECKEL, *Vergl. Anatom.*

cupies the other half of the length of the trunk; plaited throughout almost its whole extent, and generally of equal width, and rather narrow, the intestinal canal merits in its greatest part, the name of *small intestine*; it is only near the posterior region of the trunk that it enlarges into a capacious cylinder of varying length, which represents the rectum. The separation of those two portions of the intestine is either by a contraction, or by a transverse fold, or by a valve more or less distinct, followed at some distance by one or more similar divisions. Some species of the genera Tortrix, Homalopsis, and others, have a small cœcum near the entrance of the small intestine into the rectum. Another well-developed valve is formed at a little distance from the anus, and separates the rectum from the cloaca. This latter cavity is very spacious, and is often prolonged as a pouch below the valve; it is always in this that we find the ducts of the urinary and generative organs terminate. As carnivorous animals the Ophidians have a short intestinal canal, relatively to the dimensions of their bodies; we find, however, in the different genera, very distinct modifications in this respect. The Boa, for example, has very capacious small intestines, but they are very short, and consequently convoluted. This canal becomes more developed in its longitudinal dimensions in the Elaps, in several of the genus Coluber, &c. In the greatest number of other Ophidians, especially in the Homalopsis, the convolutions are very numerous.

The *muscular tunic* of the sides of the alimentary canal is in general little distinct: below the œsophagus it becomes more sensible as we approach the spacious sac representing the stomach: it is the same with the true intestines, in which the muscular tunic becomes stronger towards the rectum than in the small guts. The interior tunics of the alimentary canal are longitudinally convoluted. These folds become more numerous in the stomach where they are less regular, crossing each other in different directions, and presenting very distinct ridges; they disappear when those parts are distended with aliment. Similar folds or ridges are seen in the rectum. The mucous coat

of the small intestine presents a different structure: it always seems like velvet, from the infinite number of delicate fringes with which its inner surface is invested; sometimes, as in the Python bivittatus, these villosities are so marked that they hang in the form of small bunches; in the Eryx also they form flat papillæ, very closely set, and in the form of leaves. All these appendices disappear, however, towards the end of the small intestine, where the longitudinal folds are observed of considerable size: the Pythons alone have this part of the intestine provided with transverse folds, analogous to the valvules which separate the small intestine from the rectum.

OF THE PANCREAS.

The *Pancreas*, constantly placed in the first curvature which the intestine makes below the pylorus, has a form and size very variable in different Ophidians, and presents in this respect accidental differences. This organ is divided into a greater or less number of lobules, each of which is sometimes provided with a distinct excretory duct. These canals are generally united to each other in accompanying the biliary duct, and pour the pancreatic juice into the intestine, at a little distance from the pylorus.

OF THE SPLEEN.

All Ophidians have a *Spleen* of a globular or oval form, of a pretty firm consistence, and usually concealed behind the lobes of the pancreas, with which it is sometimes intimately united; and hence some have mistaken this organ, or denied its existence. Its position varies in several species, so as sometimes to occur at a distance from the pancreas, and isolated at the posterior surface of the stomach. Having even observed individual variations in this respect, I am led to believe that the place which this occupies is of small consequence in the exercise of its functions.

OF THE LIVER.

The *Liver* in all Ophidians presents the form of a long riband, diminishing towards its extremities, sometimes imperfectly divided into two lobes, extending along the œsophagus and stomach, from the heart almost to the pylorus. The conformation of this organ depending in a great measure on the general figure of the serpent, it will be superfluous to describe the innumerable modifications it undergoes in the different species; it is sufficient to state, relatively to its length, that the posterior extremity of the liver sometimes touches the pancreas, while in other serpents it remains at a considerable distance. The hepatic duct proceeding from the interior surface of the liver, descends towards the pancreas, to conduct the bile into the small intestine. It is in this region, and generally covered by the pancreas, that the reservoir is situated, destined to receive the bile, which, as has been very well remarked by DUVERNOY,* can only arrive there by a sort of regurgitation. Constantly filled with an abundant fluid, the *gall bladder* discharges it in digestion by a short duct, which unites, under an angle more or less acute to the hepatic duct; the ductus choledocus, so formed, is lodged between the lobules of the pancreas to penetrate the small intestine; its orifice is recognised by a small border very indistinctly marked.

OF THE KIDNEYS.

The kidneys of Ophidians, remarkable by their unsymmetrical position, and by their lengthened form, are divided into a great number of little lobes adhering to each other by cellular tissue; they are usually preceded by extremely small bodies, which probably represent the renal capsules: placed most generally at a short distance from the anus, the kidneys extend a good way up the abdominal cavity. The ureters, canals of greater or less length,

* *Annales des Sciences Naturelles*, xxx. p. 125.

according to the distance of the kidneys from the anus, are of considerable size, longitudinally plaited on their inner surface, sometimes enlarged at their inferior extremity into a canal of varying size, originating from the superior end of the kidneys, and extending along the external border of these organs: they discharge the urine into the cloaca: their mouths are marked by two prominences, sometimes very distinctly salient, and prolonged into a cylindrical protuberance. These same prominences perform the office of a penis, for it is by them that the sperm is discharged: the vasa deferentia open into the ureters. This being established, we must consider the two bodies which the male introduces into the cloaca of the female during copulation, and which afterwards are drawn within the tail, as simple *holders*, by means of which these animals join or stimulate each other during that act.

OF THE ORGANS OF GENERATION.

The dimensions of the bodies of which we have spoken in many species, the prickles with which they are often bristled throughout all their length, and, above all, the circumstance that they convey no liquid, are sufficient proofs to establish the assertion above stated, and to show the analogy between the arrangement of the true generative organs in Birds and Ophidians. This *false penis*, which is found also among Saurians, is always a compound of two symmetrical bodies, exactly alike, which occupy the space at each side of the tail left by the transverse and inferior spinous processes. Each of these bodies is formed of a prolongation of the skin of the anus, which, descending under the tail, forms a cylinder more or less long, and closed at every point. Exteriorly enveloped by tendinous membrane and by a distinct muscle, the inner surface of this cylinder is furnished with numerous appendages, some of which are soft, others hard; some close set, little developed, and not conspicuous; while some are large, scattered about as prickles. This cylinder afterwards contracts, the prickles take the form of rugosities, their sides augment in thickness, and their structure assumes an analogy

to the corpora cavernosa of the penis of the superior classes of the animal kingdom. Finally, at the distance of one or two inches from the anus, this body terminates in a conical muscle, so much elongated that it sometimes extends to the end of the tail. The apparatus we have described, on projection during copulation, inverts itself like the finger of a glove, and it is in this state that its inner surface, now become the outer, is observed to be bristled with prickles. The form of these organs differs in different species of Ophidians, both in volume and in length; but no species presents so singular a conformation of them as the *Coluber canus* of the Cape, the false penis of which is very long, garnished with numerous, thickly-planted, small prickles, each one completely divided, so that there are two false penes on each side, or four in all.

In the same region, in female Ophidians, is found a pouch called the *anal pouch*. It is formed of a white, elastic, and very tenacious membrane, of which the interior surface secretes a fœtid liquid, smelling strongly of garlic; when attacked, serpents squirt this liquid through the orifices of these pouches at the side of the anus. I have discovered organs extremely similar in the males of several species; they are, in those instances, less developed, and are situated below the false penis; but in a great number of Ophidians, the male sex is unprovided with these pouches, or they are replaced by a pouch lodged in each side of the base of the tail, in the anal cavity itself.

The organs of generation, properly so called, in Ophidians, are always found within the abdominal cavity, occupying the hypochondric regions in front of the kidneys: the *testicles* and the *ovaries* are equally remarkable by their slender form, compressed by their position, and as wanting the symmetry observed in other animals. They are shut up, with the kidneys and the lower part of the intestine, in the envelopes of the peritoneum, a membrane which is often stained of a black colour in the lumbar region, as takes place in various other reptiles, and in many fishes.

The *ovaries* contain a great many eggs, of varying size, and disposed in two rows. The oviduct, in order to re-

ceive the eggs, is enlarged and terminated by a fringed border at its anterior end; this canal descends straight towards the anus, and terminates by a wide opening in the bottom of the cloaca, below the valve which separates that cavity from the rectum.

The *testicles*, of a variable form in different species of Ophidians, are of a deeper colour than the kidneys. The vasa deferentia go out from the internal surface of the testicles; in making numerous little turns, they descend along the external edge of the kidneys, and are adherent through their whole extent to the ureters; approximating on the back of the cloaca, they perforate the walls common to this cavity and the ureters, and open into the mouths of these last, which are indicated, as we have already stated, by a conical elevation. The mouths of the vasa deferentia are so delicate that they are only perceptible in serpents of a large size,—a circumstance which renders anatomical researches very difficult, because we can neither inflate the organs, nor pass a probe, on account of their convoluted structure.

OF THE DEGLUTITION.

The manner in which snakes swallow their food is very simple. They always commence at the head of their prey, which they receive into their mouth; while the teeth fasten themselves on one side of their prey to hold it fast, the opposite jaw advances, and the teeth engage themselves in the victim, and draw it inwards. By this alternate play of the jaws, during which the principal part is performed by the lower jaw, the *deglutition* is effected, after efforts more or less great according to the volume of the prey. It is also for the same object that the jaws dilate, in order to render the swallow more capacious: during this act, the serpent discharges an abundant saliva on its prey, which it renders more slippery, and more easy to be swallowed. When the animal they attempt to swallow is too large, they are unable to introduce it into their maw until a considerable time has elapsed. Serpents found in this state offer a hideous spectacle; the disgust which they thus inspire,

augmented by the mephitic odour which the prey, already attacked by putrefaction, exhales, has given rise to numerous fables of which the poets have taken advantage. Deglutition takes place in the same manner in all serpents, not excepting the venomous snakes, who, in this operation, depress their fangs, and conceal them in the sheath of the gums, in order to defend them from injury.

OF THE DIGESTION.

The digestion goes on but slowly, notwithstanding the activity of the gastric juice of serpents. It appears, however, that this fluid is only secreted in abundance by that portion of the stomach near the pylorus; for the animals which are taken out of the stomach of snakes are always decomposed at the lower portions, whilst the parts near the œsophagus do not exhibit the slightest trace of putrefaction. I have verified this fact, discovered by M. Lenz,* in a great number of exotic species. In captivity, serpents reject by the mouth indigestible substances, such as feathers, hairs, &c. This faculty is common to them with most birds.

When a serpent is pursued that has swallowed its food, it often disgorges it, in order to escape more quickly.† This fact is also observed in many birds.‡

OF THE ORGANS OF CIRCULATION.

The heart of Ophidians has generally an elongated form, and is noted for its being placed far from the head. It is sometimes found at the distance of the first third of the length of the trunk. We find it with large auricles separated from each other by a membranous septum: the ventricle, on the other hand, is imperfectly divided into two narrow cavities, by a partition derived from the base of the

* See for the deglutition of snakes, Researches of M. Duges, inserted in the *Ann. de Sciences Nat.*, 1827, xii. p. 362.

* P. 48.

† Note communicated by M. Dieperink at Paramaribo. See also Lenz, *l. c.*

‡ The Stercorea, the Gull, and the Sea-swallow, &c.

heart, and losing itself in the fleshy fibres of that organ. The walls of the auricle, although fleshy, are thin; those of the ventricle are of considerable thickness, especially on the left side of the portion which extends, in the form of a conical appendage, under the left auricle. Each auricle communicates with the ventricle by an opening of some width, but capable of being closed by a valve. The right auricle receives all the veins of the body, with the exception of the left jugular; which, before it perforates the walls of the auricle, forms a sac of variable length, and has, besides the ordinary tunics, a well-defined muscular coat: two great valves serve to close the common entrance of the veins into this auricle. The blood delivered into the right chamber of the ventricle is propelled into the pulmonary artery, the entrance to which is shut by two valves, included, at its origin, in the common aortal trunk; this artery bends below the left aorta, and receding from it, approaches the lungs, passing along their posterior surface, before penetrating into that organ. A single pulmonary vein, proceeding from the lung behind the artery of the same name, carries the oxygenated blood into the left auricle, which is of a conical form, and less capacious than the right auricle. The oxygenated blood, after having passed into the left cavity, is propelled towards the right side, where it encounters the orifices of the two aortæ, each provided with two semicircular valves, even when these two openings are united into one; as I have repeatedly observed. We have already stated that all the arteries arise from the same trunk, the interior of which they may be said to penetrate; the arteries, however, are most frequently separated from each other by partitions, which, although each at the same time serves for the walls of two adjacent vessels, prevent the blood they carry from mingling before it enters the heart. The right artery is considerably less capacious than the left, and is divided within a short distance of its exit from the common arterial trunk into several branches, which are the sole arteries of the neck and head; it then bends backwards and descends behind the heart to unite with the left aorta, which has followed a similar course on the other side. This great artery then descends along the body, and only

disappears at the extremity of the tail, supplying in its course the neighbouring organs. After giving off the intercostal arteries, it sends branches to the stomach, the liver, the organs of generation, and to the kidneys. The mesenteric artery arises opposite to the pylorus, and several other branches are distributed on the intestines. The right aorta, before descending behind the heart, sends a considerable branch to the head, which is named by CUVIER the *artery of the neck.** This branch, after furnishing the intercostal arteries to the neck, perforates the flexor muscles of the head, where it is lost. The carotids arise from the trunk of the right aorta near its base; they extend along the œsophagus, towards the head, into which they penetrate, after being divided into numerous branches, which supply blood to the organs within the head. This disposition of the carotids, described from the Boa constrictor, is by no means the same in all other serpents, which, in general, have only one carotid,† that on the left side: this artery alone furnishes the whole blood to the head. - The carotids send a small branch to the thyroid gland, and other branches to other organs inclosed in the cavity of the neck. Two jugular veins, adherent to the carotids, descend along the œsophagus, carrying back the blood from the head to the heart. I have observed in a Boa constrictor three unequal veins preceding the vertebral column; the first, near the head; the second, about the middle of the neck; the third, in the abdominal region. It is evident that to reach the heart, the latter rises up, whilst the others descend. The vein, which carries back the blood from the posterior parts of the animal, divides to form the two renal veins, which pass along the whole length of the interior surface of the kidneys, from which they receive a great many branches: after having given rise to a vena cava, the branch of the right side unites to that of the left side to form a large vein. This is the inferior cava, which penetrates among the parenchymatous substance of the liver, to receive the blood brought by the vena portæ, in passing out of the superior

* Arteria Vertebralis, SCHLEMM, i. 1.

† The artère carotide commune of CUVIER; arteria cephalica of SCHLEMM.

part of the liver, which projects as a point. This vena cava runs a short distance, and enters as a principal part in the formation of that venous sac described above, which communicates with the right auricle, and in which several other veins terminate: a species of valvules are observed at the mouth of each of these veins.*

The heart of Ophidians has constantly on its upper surface a conglomerate gland, more or less in size, and surrounded by several other glands differing much, according to the species, in form and number. This first gland has been regarded by several naturalists as analogous to the thymus; by others, and I am of this number, it has been compared to the thyroid.†

OF THE RESPIRATION.

To obtain an idea of the *respiration* of Ophidians, we must examine with attention a serpent in the state of repose. We then observe that the trunk contracts and dilates alternately by the play of the ribs, and that the movements are slowly repeated at regular intervals; but we observe also, that the nostrils remain closed during this operation, and only open at considerable intervals, during which the body often has contracted thirty times. It results from these remarks, that the lungs of Ophidians, besides their ordinary function, have to act as a reservoir for atmospheric air: this reservoir, filled by a single inspiration, contains a sufficient quantity of air, in order that the oxygenation of the blood can take place by the contractions of the lungs, without the necessity of a new inspiration, which only follows the expulsion of the air contained in the lungs, from which the oxygen has been totally absorbed.

The structure of the lungs of Ophidians clearly proves what we advance; it is chiefly remarkable for two circumstances, *first*, because the lung usually terminates in a blad-

* The description of the organs of circulation has been chiefly taken from the Boa constrictor. For further details consult the labours of Cuvier, *Leçons d'Anat. Comp.*, vol. iv.; Schlemm, in Tiedemann *Zeitschrift*, vol. ii., p. 1, pl. 7; Retzius' *Schwed Verhandl.*, 1830, and the *Isis*, 1832, p. 524; Meckel, *System*, vol. v. p. 218.

† Consult the excellent memoir of Haugstedt, entitled *Thymi Descriptio*, p. 152.

der or sac without cells, simply formed by a prolongation of the serous membrane enveloping the lung; and, *second*, because the most considerable branches of the air-tubes open into this cavity of the lung. By this first arrangement, the lung of the Ophidians becomes a reservoir so spacious as to contain a volume of air, equivalent to a great number of inspirations; by the second, the air contained in this reservoir can be forced into the cells by the contractions of the thorax, without the necessity of a fresh inspiration.

The figure of the lung undergoes numerous modifications in the different species of Ophidians. The form of that organ is generally that of a simple sac, conical, and extending from the heart towards the lower region of the stomach, where it terminates in a membranous pouch. The *trachea*, consisting of a great number of semi-annular cartilages united anteriorly by a membrane, ends in the upper part of the lung by an oblique opening; this organ divides into two branches in the Boa, in most of the genus Tortrix, the Dipsas, and several other Ophidians, where we find a vestige of a second pulmonary lobule, sometimes about half the size of that on the other side. The air-cells of the pulmonary cavity of other Ophidians extend on the membrane which unites the rings of the trachea, so that they sometimes occupy this membrane through all its length. There are other species in which that membrane is much dilated, and incloses a number of air-cells, as considerable as the lung itself. In the Xenodon severus, in the true poisonous snakes, and in some other Ophidians, this membrane enlarges into a capacious sac, which alone contains all the air-cells; so that from this peculiar disposition, we find the lung displaced completely by this organ, which, contrary to what we observe in other Ophidians, is situated in the fore-part of the neck, between the glottis and the heart. The position of the organs of respiration in sea-serpents is still more extraordinary. In the Hydrophis colubrina the trachea is prolonged to the hypochondria, where it terminates in a membranous sac, which extends to within two inches of the anus; but, instead of a membrane uniting the tracheal rings, it is the lung which invests it through its whole length. In the Hydrophis pelamis, the trachea, dilated at its origin and contracted to-

wards the heart, forms a very narrow canal, and descends behind the stomach, where it again enlarges into a very capacious sac, the end of which extends to the anus, lodging itself between the inferior spinous processes of the tail. The air-cells in this are far less numerous than in the former species, although they accompany the trachea, from its origin to the point where it forms that spacious appendage, which probably also supplies the place of a swimming-bladder.

This arrangement of the respiratory organs, varying in the different species of Ophidians, demonstrates that the form of the organs has an important influence on the exercise of their functions; and that it is erroneous to deduce characters for the classification of serpents, from these anomalies of form, or to regard the species in which the lung is divided into two lobes, as consuming a larger volume of oxygen, and consequently as possessed of a more perfect organization.

The principal air-cells are sometimes supported by narrow cartilaginous slips, which are lost in the minute tubes forming that part of the pulmonary tissue where oxygenation goes forward. The upper end of the larynx is surmounted by the two arytenoid cartilages, which leave between them a simple longitudinal fissure, the glottis. This simple apparatus, moved by two pairs of muscles, represents in Ophidians the organ of voice, which, however, consists merely in hissing, more or less acute, produced by the air forced from the lungs. The opening corresponds to the interior aperture of the nostrils, and is more or less approximated to the end of the snout, according as the species frequents the water or the land.

The smallness of the *brain* of Ophidians is especially conspicuous, when we compare the volume of that organ with that of the head, in species in which the organs of mastication have acquired their fullest development. In front, the two hemispheres are prolonged as they contract into the olfactory lobule, so that this part is placed on a

very long peduncle; we observe on their posterior surface the optic lobes, of considerable size, and passing below the hemispheres to reach the eye, and to form the optic nerve. The cerebellum is a small organ situated behind the optic lobules, almost in a line with the spinal marrow, and shews but a small protuberance.* The extreme delicacy of the nerves of the head renders the examination of those parts very difficult. Besides the olfactory, optic, and auditory nerves, the fifth pair is to be traced sending off its branches, as in man, to the eye and to the upper and to the lower jaws. The great sympathetic nerve interlaces, in so many points, with the par vagum, that it is impossible to trace its origin with accuracy.

With respect to intellectual faculties, Ophidians are evidently in the same list as the animals of the two first orders of the class of Reptiles. The power of regeneration of the organs, which exists in Ophidians, has often been exaggerated; but it is little probable that it should be greater than in the Saurians, or in the Chelonians. This is certain, that when such a member as the tail is cut off, it is never reproduced.

OF THE SENSE OF SMELL.

Serpents have not a very delicate sense of smell. The extent of the mucous membrane of the nose is not considerable, on account of the simple form of the turbinated bones. The cavity of the nose differs in extent in the different species. The nostrils vary much from genus to genus, both in position, shape, and size. It may be received as an established rule, that purely aquatic species have small nostrils, directed upwards, and most frequently capable of being shut by a valve, while the nostrils of the terrestrial species, or of those that inhabit trees, are generally lateral and very open. In the burrowing serpents, those orifices almost always have an orbicular form, and are very small; they have the same form, but are more open than the nos-

* See SERRES, *Anat. Comp. du Cerveau, Atlas*, Pl. 5. fig. 126 and 127' 132 and 133 is the figure of the brain of Naja Haje, of the Aspic, and of the Viper with parallel rays.

trils of sea-serpents; but in the Homalopsis, some have them a transverse fissure in the form of a crescent.

We find in the Trigonocephalus and the Crotalus, on the sides of the snout, behind the nostrils, a large cavity, of which the use is unknown, but we may consider it, according to all appearances, as an accessory to the nose. This cavity, scooped out in the upper surface of the maxillary bone, is lined with a species of mucous membrane; it has small holes for the passage of nerves, and probably receives a portion of the fluid secreted by the adjacent glands. HOME,* who has treated of this subject in a special memoir, supposes these cavities to be analogous to the lachrymal fossa of certain Ruminants.

OF THE EYE.

We have mentioned already the diversity in the position of the *eye* in the different races of Ophidians, of the nature of that organ, of the form of the pupil, &c.; we have also stated that the exterior integuments cover the whole eye, but that these integuments are extremely thin over this organ, diaphanous, presenting the form of a hemispherical lamella, adherent to the plates which form the orbit. It is obvious that this lamella, as an integrant part of the skin, is renewed at the time of casting the skin, and that the old one is thrown off with the epidermis. The globe of the eye is generally orbicular, and is covered anteriorly by the conjunctiva, which, doubling on itself, forms a cavity, into which the tears are poured, according to the observations of CLOQUET.† The cornea is very thick, and presents a segment of nearly the same sphere as the sclerotic; this last tunic, equally thick, and very tough, is not supported by any bone or cartilage. Its two surfaces are tinged with a deep brown colour. We find at the bottom of the orbit an orbicular hole for the passage of the optic nerve, which perforates obliquely the sclerotic coat. On its external surface, the muscles of the eye, generally six in

* See RUSSEL'S Appendix.

† *Mem. du Mus.*, vii. p. 62. See also MÜLLER, and TIEDEMANN, *Zeitschr.* iv. p. 19, fig. 15.

number, are attached. The choroid, of a more close texture, has its two surfaces covered by a dark pigment. The membrana Ruyschiana is well developed. The iris has a considerable breadth; the colour varies in the different species. The retina, tolerably thick, has nothing peculiar. The lamellar structure of the vitreous humour of serpents has only lately been demonstrated.* The *crystalline* lens, of a spherical form, is more than half buried in the vitreous humour, which is not large.

OF THE EAR.

The structure of the *ear* demonstrates that Ophidians have the sense of hearing more dull than most of the class Amphibia. The small bone of the ear being buried in the flesh, implies the total want of a tympanum, and hence it follows that the sounds can only penetrate to the organ of hearing, when they cause vibration of that thick cuirasse which forms the general integument of Ophidians. This small bone, called by CUVIER the stapes, although in fact it represents the three bones of the ear in animals of a higher rank, is in the form of a thread, which usually is prolonged from one side to the articulation of the lower jaw, while the other end is enlarged into a disk, to shut the fenestra ovalis. Immediately behind that entrance to the exterior ear, another aperture is found, representing, as has been stated by M. WINDISCHMANN, the fenestra orbicularis. The same philosopher has observed, that the structure of the internal ear of the Ophidians approaches to that of all the Saurians which he has examined; that is to say, in them is formed an organ of an oval form, called the cartilaginous ring, destined to receive the nerve of hearing, which is distributed on its surface. This nerve forms on one side a very considerable enlargement, called *Lagena*, because the figure of this part resembles a bottle. See WINDISCHMANN, Pl. 2, fig. 12, for the internal organs of hearing in the *Dipsas*.

* See the excellent *Anatomy of the Python with-two-Rays*, published by RETZIUS. Isis, 1832, p. 512.

OF THE INTEGUMENTS.

The *general integuments* of Ophidians, intended to resist the influence of the elements and of external mechanical causes, form a very thick cuirasse, which invests the whole body of the animal, and is fortified by an epidermis, very hard and corneous. That it may obey the movements of the animal and the extension of parts by which the enlargement of the volume of the body is produced, it was necessary for that skin to be divided into a great number of compartments, separated by intervals, so that from this construction should result as many articulations susceptible of separation and approximation to each other. The projecting compartments, denominated *scales* when they are small, *plates* or *shields* when they are large, are formed by layers of integuments, much thicker than in the intervals, which present a skin of a more delicate organization, much contracted when the animal is in a state of repose, &c., covered with an epidermis extremely thin, a little transparent, and soft. It is obvious that these interstices are only apparent to the eye when the body of the animal is dilated; concealed almost constantly by the edges of the scales, and deprived of light, they are always of a white colour; and it is only in some species of Tropidonotus that the mucous tissue of those parts is tinted of a beautiful vermilion on the region of the heart. It is not so with that part of the mucous tissue which enters into the formation of the scales, which often shine with all the splendour of the rainbow, a brilliancy more or less vivid according to the nature of the horny and transparent epidermis with which the scales are covered. This is the reason why some serpents, and especially those of the genus Dendrophis, present a very uniform system of colour, although their mucous tissue be ornamented with the most beautiful tints. It is equally evident, that the tints of serpents should change about the time of casting their sloughs, when the epidermis is tarnished as it insensibly detaches itself from the inferior layers of the skin. Then only permitting the rays of light to pass imperfectly, it reflects them in a man-

ner different from its usual modes, and presents the colours of the Ophidians under a light much less agreeable than just after the casting of the skin.

It results from the principles just laid down, that *the form of the scales* ought to depend on the direction of the movements executed by the organs they protect. The scales of the trunk are consequently disposed in lines parallel to the contour of the ribs : the lines are intersected by other lines at different angles, and thus the edges of the scales are formed. The greater or less regularity in the form of the scales depends on the respective direction of those lines : if those lines cross each other at right angles, the scales will be of a square form ; if, on the contrary, one of those lines be more inclined than the other to the axis of the trunk, the scales will be rhomboidal, and will approach to the lanceolate, or even the linear form, according as these lines are less or more divergent from each other. It happens almost always that these lines deviate from their original direction in curving themselves to join the middle range of plates below the animal ; hence the form of the scales becomes more irregular as they recede from the back, although they increase in size. It is uniformly on the anterior part of the trunk that these lines, particularly those passing backwards, are inclined to the axis of the body ; hence the form of the scales, which cover that part of the body, should be assumed as the type in descriptions. Towards the tail, and on that member, the lines cross at almost a right angle, and these scales consequently become less irregular. The different form of the scales, on the different parts of the same individual, is very apparent on the Naja and the Xenodon, where the ribs of the neck, less arched than the others, and susceptible of a considerable movement from behind to the front, produce an enlargement of the volume of the body laterally. In the state of repose, the scales of this part cover each other by their lateral edges ; they are in form narnow or linear, while those of the tail, imbricated in the usual manner, are of a square form.

The number of longitudinal ranges in which the scales are disposed, vary not only according to the species ; these

anomalies are frequently observed in different individuals of the same species, and this number is even far from being the same in different regions of the body: it is on the neck, at a short distance from the head, that the ranges of the scales are most numerous. Towards the middle of the trunk they begin to diminish, the two scales next the abdomen being replaced by one: these ranges disappear one after another, and at the end of the tail they are reduced to a single scaly plate. The number of longitudinal ranges is almost always unequal; Ophidians having the middle line of the back furnished with a single row of scales, sometimes larger and of a different form from the rest. The only exception to this is the Herpetodryas carinatus, which has two ranges of scales along the curve of its back, and consequently has the number of ranges equal, which is more remarkable, as it is unique in the whole order of Serpents.

One is led to believe that the transverse ranges of scales should always be equal to the number of the vertebræ, or to that of the plates which defend the lower part of the trunk; but it is not so in the Ophidians whose bodies are invested with a great number of small square scales, such as the Boa, Eryx, Sea-Snakes, &c. On examining the scales of those serpents, we find, on proceeding from the abdomen, that the ranges of the scales, at first broad, become narrow, and lose themselves among other ranges of very small scales that descend from the back.

The modifications of form which the scales present in the different species of serpents, are infinitely varied. Their edges are sometimes rounded, sometimes truncated at the end, at other times pointed more or less acutely. Their epidermis is generally very hard, and the edges of the scales salient, so that they cover each other like the tiles of a roof: we designate these scales, proper to the greatest number of Ophidians, *imbricated*. Other Ophidians, on the contrary, especially sea-serpents, with the exception of a single species, have their scales covered with a very thin epidermis, and these organs, usually very small, present an hexagonal form. The skin in the intervals of the scales in these Ophidians, is much less dilatable than in other

serpents, and this peculiarity is at its maximum in the Acrochordus, in which the innumerable little compartments of the skin are not at all susceptible of being separated from each other.

The scales of Ophidians present most usually a smooth unbroken surface; but in many species they exhibit a logitudinal projection more or less sharp; sometimes mucronated, sometimes rounded, and occasionally reduced to a simple spherical protuberance, as in most sea-serpents: these are what are named *carinated scales*. The keels, sometimes nearly obliterated, as in many of the genus Coluber, only exist in the upper ranges of scales near the back. In other species all the ranges are roughened by them; but their development diminishes toward the lower parts, so that the two ranges nearest the abdomen most generally are without them. Several other species of the genus Dipsas, and more especially the Psammophis lacertina, present, on the other hand, scales scooped out into a longitudinal hollow more or less deep; but the species with this character are very few in number. We do not know the use of these differences in the surface of the scales. It has been supposed that the keels are peculiar to water-snakes; but it is not so, and we shall afterwards find that species of the same genus, and very nearly allied, differ in little else than the presence or absence of these keels: perhaps they only serve to give a greater firmness to the teguments.

The mesial line of the lower surface of serpents is generally furnished with scaly plates larger than the rest, but those of the tail are generally of a different form from those on the abdomen. These last are disposed in a single range uniformly prolonged from the anus to beneath the throat, where it disappears. These plates, of which the terminal ones are always divided into two, are sometimes very narrow, as in the Tortrix, Boa, &c., and they have some resemblance to the scales of the trunk. They are more extended in some other serpents; and in most of those animals they are very broad, mount upwards on the flanks, and surround a considerable part of the circumference of the trunk: then it is that their shape, wholly dependent on

the form of the trunk, varies according to the kind of locomotion which the animal performs, and that they are sometimes convex, at other times angular at the sides and plain below, and sometimes even sloping at the lateral angles. Their surface, entire in most Ophidians, is provided with two protuberances in the Hydrophis properly so called, which probably arises from each of them being formed of two pieces soldered together. Several other species of the same genus present this remarkable character, that the middle line of the abdomen is indicated by a suture produced by a range of scales with which each of its sides is garnished ; lastly, the Acrochordus has a salient crest running along the abdomen, which is bristled with small mucronated scales : similar scales cover all parts of the body of this genus.

The scaly plates below the tail form a single middle range in the Boa, the Eryx, and some other Ophidians. Most of the other animals of this order have that organ furnished with a double row of plates ; and it is from this circumstance that the term of *Divided plates* is derived, in opposition to simple plates or bands.

The head of Ophidians is very rarely covered by scales resembling those on their bodies ; we there find several plates, larger than the rest, covering the different organs placed in the cranium. Most serpents even have the head fortified by plates of a more or less determinate and symmetrical form, always with a smooth surface, but the arrangement and form of which are subject to innumerable modifications. As the forms of these scaly plates present characters easily comprehended, they have been employed to afford distinctive characters ; and this has given rise to a nomenclature, invented expressly to designate these organs, according to the regions they occupy. The plates of the true *Coluber* being the most symmetrical in their disposition, have been regarded as of a normal form ; and all others appearing to be modelled on this type, it is easy to describe the numerous modifications which they undergo either by excess or default. The plates which invest the immoveable parts of the cranium, as those on the top of the head, possess a movement either

very limited or null. The skin which enters into their composition is very thin, and most frequently glued to the cranium. A pairless plate is very generally observed on the summit of the head, called *The Vertical*, which may be said to present an immoveable centre, around which the other scaly plates are arranged : it is generally pentagonal, with the base toward the muzzle ; it is sometimes very narrow, at other times very wide, according to the general form of the head ; and it affects a trigonal, an hexagonal, or a lanceolate form, according to the nature of the surrounding plates ; it has an irregular shape in several of the genus Boa, or is even divided into two pieces by a longitudinal suture : in other Ophidians its volume is so reduced, that it ceases to be distinguishable from the other scales.

That plate is often followed by a pair termed *The Occipital*, plates of somewhat a trapezoidal form, but very variable in the different species : these plates are always in contact at their inner edges ; and it is only in the Tortrix scytale and the T. Xenopeltis that they occupy the sides of the head, and receive between them a middle supernumerary plate, which resembles the scales of the trunk. The occipitals never exist without the vertical : they are very small in several species of the genera Dipsas, Xenodon, Homalopsis, Hydrophis, Tortrix, Boa, &c. ; we merely find vestiges of them in the Trigonocephalus Cenchris, and they are replaced by some little plates of a very irregular form in some of the Boas.

The *Superciliary* are a pair of plates placed at the sides of the vertical, and protecting the eye from above ; they almost always run along the orbit, forming a vault very little moveable, under which the globe of the eye can freely exercise the limited movements which it enjoys. Their form and their extent vary infinitely : sometimes convex, sometimes hollowed at their external edge, most generally vaulted, and sometimes flat, they are raised up in the Acanthophis, while their surface in the other Ophidians is in the same plane as the top of the head. They are placed far back in several of the genus Tortrix, and are united firmly to the single ocular plate in the

Tortrix scytale. They exist even in many serpents whose heads are deprived of plates, and are replaced in others by a circle of little scales.

Two pairs of plates, the anterior and posterior *Frontals*, cover, in the greatest number of Ophidians, the upper part of the muzzle. Their form is, in a great measure, determined by the lateral edges of that part, so as to be very narrow in the Dryiophis, and wide in the Dipsas, &c. The anterior are smaller than the posterior: they are sometimes very small, as in many species of the genera Lycodon, Dipsas, Elaps, Homalopsis, &c.; in some of the latter genus they are reduced to a single pair, wedged in between or behind the nasals, which occupy their place; in the Hydrophis, the Tortrix, and the true Calamaria, they totally disappear, and we then see but a single pair of frontals. Their number, on the other hand, is increased in other Ophidians, as in several Boas, the Trigonocephalus hypnale, the Heterodon, and the Hydrophis colubrina; in other Boas, they are replaced by small plates of an irregular figure, which are not distinguishable from the scales. The modifications which these plates undergo in the diverse races of Ophidians are numerous, as may be seen in examining the figures in our plates.

The muzzle of serpents is always terminated by a plate more or less large, and always grooved below, to receive the extremity of the lower jaw. The form of this *Rostral* plate varies according to its use. It is most usually pentagonal; the size is determined by that of the muzzle; it is broad and very convex in most Ophidians; in others, as the Heterodon, the Naja hæmachates, the Eryx, many Trigonocephali, &c., it is obliquely truncated downwards; in the Dryiophis, it enters into the moveable appendix, with which the snout of that animal is provided.

The *Labials* are those plates which garnish the edges of the lips; they are most frequently disposed in a single row, sometimes in two or more rows, or rather, we find several supernumerary plates, inserted between the labial plates: this takes place in the Hydrophis, in several Ho-

malopsis, &c. The number, configuration, and disposition, of these plates are extremely variable; and the enumeration of these discrepancies, therefore, enter into the special part of my work; we may, in the mean time, observe, that those of the upper lip go on diminishing towards the end of the muzzle in most serpents, and the reverse in some measure takes place in the lower jaw. It most generally happens that the superior labials form the lower border of the eye.

This organ has its lateral borders furnished with small plates, denominated the *Oculars*. Several Ophidians have only a single anterior ocular, while the number of the posterior oculars varies from two to four, according to the species: sometimes they are prolonged below the eye; and in several serpents, whose heads are covered with small scales, they are small, and form a range, surrounding the whole periphery of the eye. In the Tortrix scytale, all the marginal plates of the eye are joined in one single piece, in the centre of which that organ is placed.

It rarely happens that the nostrils perforate the *Nasal* plate, without dividing it vertically into two; this, however, takes place in the genera Tortrix, Boa, Elaps, and in most of the true venomous snakes; sometimes even, as in the Elaps, the nostrils open just between two plates of different forms, the posterior of which may be considered as a *Frenal*. The form of the nasals, and their position, undergo considerable modifications in different species of Ophidians: in aquatic serpents, those plates are usually near the summit of the muzzle, and sometimes serve the purpose of the superior frontals, as in the Hydrophis; but more usually they occupy the sides of the muzzle, touching the rostral plate by their anterior edges.

These are most commonly followed by another plate, the *Frenal*, which extends to the anterior oculars: this plate is, however, wanting in a great number of Ophidians, while its place is occupied in others by two, three, or more plates, of very different extent and form.

The *Temporal plates* exist only in conjunction with the occipitals and superior labials, among which they are placed, and on which their number and form depend.

We have stated above, that the border of the lower jaw is almost constantly furnished with plates, of which the central one is at the end of the muzzle, corresponding to the rostral. The second pair are often prolonged below the chin, to unite with one or two pairs of plates, enclosed between the labials, and distinguished by the name of *Mentals* or *Geneials*. Although of a very variable form, they are rarely wanting; and their lower edge always forms that deep fissure, which so materially contributes to the enlargement of that part of the skin, and which is known under the name of *Gular Fissure*.

A more extended terminology to indicate those plates appears to me superfluous; and I shall conclude this section of the work by calling to recollection that it is easy to recognise them, provided attention be given to those terms which are invariably derived from the regions which the organs occupy: it is thus that many of those plates, which extend between the labials and the first abdominal bands, and are often divided, bear the name of *Gular* plates; the last abdominal plate, equally divided, and covering the orifice of the anus, is termed the *Anal* plate, &c. &c.

[As these distinctions, though long employed in Germany in the descriptions of Ophidians, are but little familiar to the English reader, the translator has introduced two figures, A and B, Pl. I., with references to the different plates mentioned in the text.

A

a Vertical plate.
b Occipitals.
c Superciliars.
d Temporals.
e Posterior frontals.
f Anterior frontals.
g Rostral.
h Posterior oculars.
i Anterior oculars.
k Frenal.
l Nasal.

B

n Middle labial.
o Accessory labials.
p Anterior geneials, or mentals.
q Posterior geneials.
r Marginal labials.
s Gular scales.
t Gular scuta.
u Abdominal scuta.]

FORMS.

Ophidians differ infinitely from each other relatively to their size and their *general form*. This depends in a great measure on their mode of life, the nature of the places, or the element they inhabit, and also on the kind of locomotion which is natural to them. The species which frequent trees are especially distinguished by their slender forms; while those which prefer plains, or retire into burrows, are recognisable by their compact body, terminated by a very short tail; intermediate between these two tribes as to development of parts, are a great many serpents that prefer to remain on the ground always, but can climb, and also swim, with greater or less facility; others that delight more in humid places, or never quit the water, present the most varied forms, more or less suited to this species of locomotion.

A *Trunk* laterally compressed, is observed in the greatest number of Ophidians; but no family presents this character in so marked a degree as those Tree-snakes which we have included in the genus Dipsas, and Sea-serpents which have the belly more or less completely *keeled*, in order better to cut the waters. The serpents, on the other hand, which merit more especially the name of terrestrial, such as the Tortrix, the Calamaria, the Elaps, &c., are distinguished by bodies more or less cylindrical. Others, such as the Tropidonotus, equally terrestrial, but excellent swimmers, have a belly very broad, and rounded towards the sides. Several Boas have the faculty of rendering their trunk, when gliding or swimming, of the same form as the Tropidonotus; but their trunk becomes laterally compressed by an opposite movement of the ribs, when they prepare to climb or to roll themselves inwardly. These changes in the size of the trunk which take place in such movements are found in a greater or less degree in all Ophidians, and render the exact determination of their forms very difficult: for indicating that of the body we are obliged to describe the figures which transverse sections present, one of which is made in the middle of the trunk,

and a second near the base of the tail; whence it results that serpents with compressed bodies present an oval section more or less elongated, which in the Hydrophis approaches to a lanceolate figure; in serpents entirely terrestrial, or with a cylindrical body, the section is more or less orbicular: in the swimmers, or those with large and convex bellies, the back assuming somewhat of the keeled shape, the section has a triangular form, or that of a pentagon, with the angles much rounded. This last figure is observed in the most perfect degree in serpents in which the lower part, more or less flattened, is separated at the flanks by an obtuse angle: this is termed an angular abdomen. This form is particularly observed in many of the climbing snakes; several Dendrophis even have the lateral edges of the belly furnished with a salient angle in the form of a keel.

The form of the tail is still more various than that of the trunk: this organ also has very different functions to perform. The tail of burrowing snakes, excessively compact and short, of equal thickness and conical at the point, serves to second and direct the movements of the trunk, and perhaps to dig into the earth. In the greatest number of terrestrial snakes it is a little longer, but very vigorous and conical, offering a solid fulcrum for the body, of which it sustains the whole weight, when the animal rears itself erect and stiffens itself like a stick. To fulfil the functions of an oar and a rudder, it is flattened in a vertical direction, and is short and lanceolate, in sea-serpents; but this form is not absolutely necessary for locomotion in water; for several other aquatic Ophidians have their tail of the ordinary form. When this member is long and slender, as in tree-snakes, it acquires, besides its other properties, the faculty of entwining itself around branches, and of capturing or twisting in its folds the animals on which these serpents feed. Yet a prehensile tail, in the strict meaning of the term, that is to say, one which possesses the faculty of rolling itself completely inwards, is only found in the Boas; the shorter it becomes, the more fitted it is to fix itself to any object, provided that it can embrace it; it is then sufficiently vigorous to support the whole

animal suspended from a single point. The swimming Boas have not a different formation of the tail; and it is only in the Acrochordus that it becomes slightly compressed. The end of the tail is most frequently fortified by a simple conical scale, more or less pointed or hooked; this point is converted in the Crotalus mutus into a hard spine; but the other Crotali have the tail furnished with a peculiar *rattle*, often very large, although it is but a simple production of the epidermis.

The *Head* does not always present any correspondence in form with the other parts of the body. It is, for example, very compact and thick in the Dipsas, which, however, has a very elongated body, as occurs also in the Dendrophis, although the head of the latter is very long and slender. Hence it may be perceived that the form of the head is chiefly influenced by the kind of food which nourishes the species. Those which swallow animals large in proportion to their own size have necessarily a large head, the parts of which can dilate, forming a contrast to what is found in those which live on worms, insects, or animals of small size or of slender forms. In such, the head is scarcely distinguishable from the trunk; it is generally short, rounded, and thick at the muzzle, as in the Tortrix, the Calamaria, the Elaps, &c. In the first kind of snake, on the contrary, the head is very broad at the base, very distinguishable from the trunk, and consequently very susceptible of an extraordinary degree of dilatation, as is especially the case with the venomous serpents, properly so called, and with several species of Dipsas, Xenodon, Boa, Coluber, &c. The *Muzzle* determines the general form of the head; it is sometimes short and thick, sometimes rounded or truncated, at other times slender and pointed; in some it terminates in a hard turned-up scale; in others it is drawn out into a fleshy and moveable appendage. Sometimes, as in the Homalopsis Herpeton, we observe these appendages on each side of the snout; but those which some Vipers have over the superciliary region are merely scales with pointed prolongations, more or less developed. The point of the muzzle always overlaps the lower jaw, the edges of which are lodged within those of the upper jaw; but the

grooved passage of the rostral plate allows the tongue to be projected, and prevents the mouth from being entirely closed ; and it is only in aquatic serpents that the ends of the jaws are so exactly shut up as to render the entrance of water impossible.

The *position of the Eyes and of the Nostrils* depend on the mode of life of the species. Aquatic snakes often have these organs but little developed ; they are directed to the sky, and consequently placed on the top of the head ; and it is the same with the Tortrix and some terrestrial serpents ; in others, especially in tree-snakes, they are large and more or less lateral. Terrestrial venomous serpents often have very wide nostrils ; and there is a whole family of the true venomous serpents in which these organs are accompanied by a second aperture in the maxillary region, which seems to have the function of an accessory organ of smell. It ought to be remarked, that the fossettes sunk in the lips of several Boas have no communication with the interior of the head, and therefore they present no analogy to those of the Trigonocephalus and Crotalus.

The *Mouth* of Ophidians, more or less deeply cut according to the degree of dilatation of which the parts of the head are susceptible and the form of that organ, sometimes presents straight margins ; sometimes they are in the form of an *s* ; and sometimes they mount at an angle more or less obtuse towards the commissure of the lips. The diversities of form and disposition of the parts of the head of Ophidians which we have mentioned, give to each species a peculiar physiognomy, the more characteristic as their features are more prominent ; when imprinted on the memory, it serves for the recognition of the numerous races of these interesting animals. The circumstances which chiefly contribute to render the physiognomy of serpents characteristic, are a large broad head, high, angular, cordiform, and covered with small scales with unequal surfaces, a wide mouth curved at its margins, thick lips, large fossettes on the sides of a muzzle truncated or turned up at the end, small eyes, with an elongated pupil, and overhung by salient superciliary plates—characters which are generally united in the species with clumsy forms, such as we

see in the serpents properly named venomous, and in some others. These pronounced features, however, do not always constitute the distinctive characters of dangerous Ophidians ; for many innocuous species, such as the genera Heterodon, Homalopsis, Boa, and some others, join to a farouche physiognomy, a natural gentleness ; while the Elaps, the Naja, and the Bungarus, which are not distinguishable by exterior signs from the Colubri, are provided with the same redoubtable weapons as the Viper and the Crotalus.

The *Neck* of Ophidians has often the same shape as their trunk ; and it is only in the Naja and in some Xenodons that the ribs, more straight than usual, and capable of a considerable horizontal movement, give a more flattened form to the neck. It must be remarked, however, that most serpents have the faculty of flattening and enlarging the neck, as is observed when they are enraged, and utter those hissings which usually are the prelude to an attack.

THE COLOURS.

It is not possible to lay down fixed principles on the *system of colours* in Ophidians. Sometimes uniform and dull, sometimes shining with a brilliancy equal to that of precious stones, their tints are infinitely varied, and very differently disposed, not only in the various races, but often also in species of the same genus. In others, on the contrary, we observe in allied species a certain uniformity in the distribution of the colours, which are often analogous to the surrounding objects in the places inhabited by these animals. Many climbing serpents, for example, present a livery of uniform green, absolutely resembling that of the leaves ; while others, as many species of Dendrophis and Dryiophis, in this respect resemble small naked branches ; and, lastly, in the Dipsas, the system of colouring simulates the old stem of a tree covered with fine and luxuriant mosses. The serpents which frequent fresh water are generally remarked for their sombre and uniform tints ; the green, the yellow, and the blue colours which ornament the bodies of sea-serpents confound them with the waves

of the vast ocean. The inhabitants of the desert, as the Eryx, the Egyptian Viper, &c., are scarcely distinguishable from the sand, so uniformly spread over those dismal wastes; other snakes, the *Burrowers*, are recognisable by their beautiful shining, strongly irridescent colours, among which red is predominant on the lower parts. A multitude of other Ophidians present colours which sometimes imitate the dusky brown of a boggy soil, marshy, or shaded by thick forests, sometimes the green of herbs, sometimes the diversified tints of places clothed with mosses and lichens; and some have their livery adorned with the most brilliant hues, in rivalry of the splendours of the flowers of a tropical vegetation. The species included in this latter category are chiefly found among terrestrial snakes, and among those that climb. Thus, we might instance, as the most beautiful Ophidians, the species whose bodies are surrounded with alternate bands of vermilion and black, white or yellow; such are the Coronella venustissima and C. coccinea, the Lycodon formosus, many snakes of the genera Tortrix and Heterodon, most of the Elaps, the Naja lubrica, the Dendrophis ornata, and the Dipsas macrorhina. Other Dendrophis, many Dryiophis, certain Dipsas, &c., are equally remarkable for the splendour and diversity of tints which adorn their livery.

The distribution of the colours is infinitely varied in serpents; some have the body longitudinally striped or *rayed;* others are surrounded by transverse bands; sometimes they are spotted, at other times sprinkled over with dots or marblings; sometimes there is a clear ground, which is relieved by markings of every sort, at other times dark hues are the prevalent colours, so that the ground colour is indistinctly visible; hence the great difficulty of describing the infinite shades of colour in the livery of serpents. This difficulty is augmented by the changes which the tints undergo from age in the different stages of life, &c.; they are still more frequently different in the two sexes, and the accidental varieties observed in this respect are very numerous. The vivacity of the tints undergoes continual metamorphoses from the casting of the skin. It is a general

law, that the younger the individual the more vivid are the colours, and more distinct in their distribution; and often the tints which adorn the young are effaced in the old, or they become absolutely uniform; for instance, in the Coluber canus, C. melanurus, the Homalopsis buccata, the Xenodon severus, and others.

The faculty of spontaneous change of tint,—a faculty which many Batrachians, a great number of Saurians, and particularly Cameleons, possess,—is only observed in an inferior degree among Ophidians, and that principally among the climbing serpents distinguished by their green colour.

The differences which exist between the relative colours of the male and female, and the changes produced in either sex at the principal periods of life, have been little studied. Sometimes, as in the Tropidonotus Natrix, the two sexes perfectly resemble each other; but this is not the case in the Common Viper, in which the markings of the female undergo successive changes before the individual attains the term of its full growth; whilst the males on coming out of the egg, present tints analogous to those of the adult of the same sex.

We have spoken above of the great influence exercised by the casting of the skin on the beauty of the original tints. The changes which it produces are so much more worthy the attention of the naturalist, that the *moult* operates by insensible degrees, and takes place several times in the year.

It happens almost constantly that the tints of Ophidians are effaced in a great measure after death, or that, when exposed to the action of ardent spirits, they suffer changes more or less marked. The black, the brown, the ochre-yellow, and many other such colours, do not, however, always lose even the lustre reflected by the uniform surface of the scales; among the number of the species which retain their colours after death, are the Calamaria arctiventris, C. Brachyorrhos, the Tortrix maculata, the Xenopeltis, the Coronella rufula, the Lycodon Hebe, and L. subcinctus, the Coluber Constrictor, C. Æsculapii, C. melanurus, several species of Naja, Homalopsis, Vipera, and a great many

others. The green colour tarnishes after death, loses its vividness, and passes to blue : it gives out its tint to alcohol, which thus becomes coloured. The white almost always loses its purity, and becomes faded or yellow, while the bright yellow passes to white. It is the same with the beautiful red tints, with which the bodies of many snakes are adorned ; this colour almost totally disappears after death, passes to a yellowish white or to a brownish hue. The blue, so rare among the order of Ophidians, is in most of them effaced, and the same happens to the spots of bright green. Almost all the other intermediate tints tarnish, or lose, at least in part, their brilliancy, after being exposed to the action of alcohol.

OF VARIETIES.

Among the *varieties* which are so often observed in the reptiles of which we treat, we must regard many as due to the influence of climate : others, generally very constant, are only separated by discrepancies extremely slight, such as difference of tint, &c., from the typical species inhabiting the same places ; but the greatest part of the varieties are purely accidental, and offer modifications as innumerable as diversified. Every part of the animal is subject to these accidental variations ; they principally consist in different shades and distributions of the colours, in the form of the scales of the head, in the length of the tail, in the number of abdominal plates, sometimes it is the forms which are subject to modification. Experience, and the constant endeavour to reduce as much as possible analogous individuals to the architype, are the only means of smoothing the difficulties which beset the zoologist in the determination of species. Setting out with these views, we must not regard as species the varieties produced by climate, whatever be their characters, even when they remain constantly the same in the same place. The study of these local variations, hitherto neglected, is of the utmost importance for an accurate knowledge of the creatures which inhabit our globe. We have, in consequence, taken care to introduce in the de-

scriptive part of our work detached observations on this subject.*

OF MONSTROUS SERPENTS.

Monstrous serpents have been, though rarely, observed: to this number pertain the Coluber with two heads taken on the banks of the Arno, which REDI kept alive during several weeks, and of which he has furnished a description in his works.† LACEPEDE has collected several other facts relative to snakes with two heads, and gives a figure of a similar individual preserved in the galleries of the Museum of Paris.‡ The figure of a third serpent with two heads is given by EDWARDS.§ M. DE FRORIEP possesses also a specimen, in which two heads and two tails are perfectly separated. M. MITCHELL‖ makes mention of several monsters of this sort, observed in North America; the heads of these subjects being, more or less, united together, so that some of them had but three eyes, and a single lower jaw. In the same country, a serpent was found of probably the species called Coluber constrictor, of which all the parts were so disfigured by disease that it was imagined they had found, in that monster, the famous sea-snake of the north, so celebrated for its vast size. See an extract of the dissertation published at Boston on this subject, in the Journal de Physique, volume lxxxvi. p. 297.

[The translator has a drawing of a small specimen of Vivera berus with two distinct heads, found in Dumfriesshire. The specimen was shewn to him by the young gentleman who found it about 4 years ago. In BANCROFT'S *Guiana* is figured another snake with two heads.]

* [These, and many similar remarks, chiefly refer to the second part of the author's work on "The Physiognomy of Serpents," which, I fear in the present low state of this branch of natural history in Britain, will not readily find a publisher.—*Tr.*]

† *Observatio*, iii. p. 1.

‡ *Quadrup. ovipar.*, ii. pl. 20, fig. 2, p. 475.

§ *Birds*, pl. 207.

‖ *Silliman's Journal*, x. p. 48. See *Isis*, p. 1046.

ENEMIES OF SERPENTS.

Serpents have numerous enemies among animals. Universally detested, man kills them, indifferent whether they be venomous or inoffensive, wherever he detects them. All the countries of the globe produce certain mammifera, that pursue serpents with persevering keenness. With us, it is chiefly the badger, the hedge-hog, the weasel, the martin, and the pole-cat, that contribute to the destruction of serpents; in the tropical countries of the ancient Continent, they encounter terrible enemies in the civet, the ichneumon, and other carnivora. Several birds wage on them a continual war, such especially is the serpent-eater of the Cape, mounted on its long stilt-like legs, as it would seem on purpose to render the bites of snakes ineffectual; in South America, the laughing falcon, and other birds of prey, pursue them eagerly; the large storks of India, such as the gigantic Ciconia, destroy an immense number of serpents; in Europe, we should reckon among their enemies besides the storks, ravens, kites, and several buzzards. In tropical seas, there exist sharks that devour with avidity the sea-serpents; and lastly, many Ophidians make war on each other, not even sparing their own species.

By transplanting animals, the enemies of serpents, into countries infested by them, we might perhaps prevent the too great multiplication of these dangerous reptiles. This attempt has been made, by transporting the Snake-eater of the Cape to the French West-Indian sugar-colonies;* perhaps the mammifera which we have mentioned, or the storks might render them as good or better services.

We can easily kill serpents by blows with a stick, and breaking their vertebral column; but besides that this method could only be adopted with the smaller species, it has the disadvantage that the specimens thus killed are of little utility for the cabinet. To avoid this, it is better to fix them to the earth with a staff provided with a sort of pincers on its end, by which their bodies may be seized

* CUVIER, *Regne Animal*, tom, i. p. 339.

near the head. Large species, or those that inhabit trees, we are often obliged to shoot with a gun. Aquatic snakes sometimes are caught in the fisherman's nets, and this is probably the only method to obtain them, since in swimming they never expose any part of their bodies above the water. But the greater number of innocuous serpents are easily taken with the hand, either in seizing them by the neck or by the tail. Several, however, have the power of turning round to bite, while others soil their assailant with a fœtid fluid, which they can eject to a considerable distance. It is not within the scope of our work to explain the various methods which may be employed to give chase to serpents: for more complete information, the work of M. Lenz may be consulted, who treats fully of this subject, and to whom a long experience has taught the means of easily capturing those dangerous animals, and how to shun, at the same time, the numerous risks which they run who pursue that occupation. In the same work will be found observations relative to the best method of destroying these noxious reptiles, or at least of preventing their too great multiplication. The means enumerated by this philosopher, are chiefly included under the following heads:—In the first place, to destroy the animals which serve as food for snakes, as bats, rats, frogs, and the like; to favour the enemies of serpents mentioned above, among which the stork occupies the first rank, as doubly useful by the havoc it also makes among frogs; afterwards to burn the vegetation on the places infested by numerous snakes, or when these are in plains, to bring them into cultivation; lastly, to offer a premium to those who can produce certain parts of the snakes they had killed, abolishing at the same time the premium paid for the destruction of the birds of prey that feed on serpents, such as buzzards, kites, and crows.

Several species of *intestinal worms* infest the viscera of serpents. I have often found the stomach, near the pylorus, so full of them, that their presence must have caused continual obstructions, if not death; these worms formed a mass hanging on the internal walls of that intestine. Some are confined to the intestinal canal, others to the mesentery, and some exist even in the serous mem-

branes, especially in those investing the heart and lungs. The intestinal worms observed by M. RUDOLPHI,* in different species of Ophidians, belong to the following genera:—Ascaris, Distoma, Filaria, Echinorhynchus, Tænia, Strongylus, Trichosoma, Pentastoma, and Cucullanus.

The *Parasites* which are exteriorly attached to the skins of serpents, and suck their juices, are much less numerous than those we have just mentioned. Only a single genus is found, the Ixodes, and especially that with a gilded thorax, which I have also observed on the Monitor Lizard, on the Hog, the Pangolin, and some other East Indian animals. M. MULLER† has described this insect. METAXA‡ has observed on several Ophidians of Italy, parasites which he has recognised as forming two species of *Acarus*. DAUDIN§ speaks of others found on the Boa Cenchria. I have detached some of them from Pythons, from the Dipsas dendrophila, and several other Javanese serpents.

Serpents are *useful* by the destruction of hurtful animals, such as the small *Gnawers*, worms, insects, mollusca, &c. which they pursue. Formerly snakes were employed in medicine, and this practice is still retained by many people, although it has been rejected by the more refined nations. Very recently Dr MARIKROSKY,‖ of Rosenau in Hungary is said to have employed with success the bile of serpents in cases of epilepsy.

[Snakes are still much employed in the pharmacy of Spain and Southern Italy. The translator found living snakes in the apothecaries shops in the former country as regularly as sarsaparilla with us.]

The *prejudice* against serpents in many countries is greatly superior to their utility. The venomous species multiply so in certain intertropical countries, and particularly in the Island of Martinique, that they are a real plague, and annually cause the death of a great number of men and domestic animals. The Aquatic snakes often do much damage in lakes and rivers abounding with fish;

* *Entozoorum Synopsis*, p. 762.
† *Ixodes Ophiophilus*, *Aata Nov.* xvi., part ii., p. 232. (Pl. lxvi.)
‡ *Monograph*, § 7 and 9. § *Rept.* vol. v., p. 202.
‖ HUFELAND'S *Journal*, année 1831, cah. 10.

the terrestrial species devour mammifera and birds useful to man, and very often destroy the nests to devour the eggs or the young.

PROPAGATION.

In our climates, where serpents only produced young once a year, *copulation* takes place most frequently in the first fair days of April or May. For this act the two sexes entwine their bodies together, so as to seem only a single individual with two heads looking face to face ; the male then introduces into the female cloaca the two cylindric bodies covered with spines, which on being turned inside out are drawn from under the tail: the two sexes remain thus united for several hours ;* but we are unable precisely to fix the duration of their copulation. It is, at least in our indigenous species, a space of three or four months, before the eggs are ready to be laid ; during this interval they undergo a species of incubation in the belly of the mother ; for on opening the eggs just after they are laid, we almost always perceive a fœtus more or less developed, and sometimes even perfectly formed. In this latter case, the young are shut up in a thin membrane, which they tear at the moment of birth to commence their independent existence. In a great number of serpents, on the other hand, the eggs are enveloped in a very tenacious tunic of a coriaceous nature, or rather resembling parchment ; the young, being only imperfectly formed when the eggs are laid, they require sometimes the space of a month more before the hatching is accomplished. On this depends the distinction which has been made between viviparous and oviparous serpents : a distinction which, indeed, is not founded on any other ground than a greater or less development of the fœtus in the egg at the time of laying, or on the nature of the exterior covering of the egg. Ophidians are really always oviparous, and it is wrong to compare this species of generation to that of the mammifera, where the young receives its nutriment through the medium of the placenta.

* Lenz, p. 52.

The necessary conditions for the development of the *Embryon* in the egg are, according to M. HERHOLDT,* the humidity produced by a feeble vegetable fermentation conjoined to a moderate temperature, amounting to between + 20 and + 6 R. (from 77° to 46 F.); and finally, circumstances favourable to evaporation and absorption through the exterior covering of the egg. Hence serpents seek to deposit their eggs in places where these conditions are combined, as in a dunghill, or a mass of leaves collected in places exposed to the sun; it is the same reason that induces many oviparous species to establish themselves in the vicinity of houses, or conservatories.

It has been erroneously advanced that venomous serpents are always viviparous, and that serpents not venomous alone lay eggs: it is not so; for many of the latter are viviparous, while certain species of the former tribe lay eggs, like the majority of the Colubri. It even appears that this diversity in the generation has no relation to the organization of the animal itself; for these two modes of reproduction are sometimes observed in nearly allied species of the same genus; the Coronella lævis, for example, produces living young, as our common viper; but several other Coronellæ lay eggs inclosed in a coriaceous envelop; the same is the case with the Python bivittatus, whilst the Boa murina is completely viviparous: among the venomous snakes, the Najas, and several others are oviparous.

During the laying, serpents keep themselves stretched on the ground, and only lift the tail to permit the eggs to escape; this operation is neither long nor painful.† The *eggs* of Ophidians contain, before the development of the embryon, a homogeneous fluid of a deep yellow colour, analogous to the yolk of the eggs of birds. The white fluid appears to be wholly wanting in the eggs of serpents: they are also distinguished from those of birds by the total want of the air vesicle. The yolk is covered by a proper tunic, provided with numerous bloodvessels, the principle trunks of which unite with the canal of the vitellus at the umbilicus of the embryon: this membrane, named Allantoid

* *Oversigt*, 183, p. 4. † LENZ p. 498.

by several physiologists, has been regarded by others as analogous the Chorion.* Probably this tunic is composed, as in the eggs of Tortoises, of two lamellæ, the exterior of which, containing the bloodvessels, may perhaps be compared to the chorion of the embryon in mammifera, while the interior is the true allantois.† The embryon itself is shut up in a serous membrane, the amnion. The canal of the vitellus enters the small intestine near the pylorus ; but the umbilical opening is not always found opposite to that region: in the Trigonocephalus atrox, where it is near the anus, the canal of the vitellus is obliged, in order to enter the duodenum, to mount in the interior of the abdominal cavity the whole length of the intestines.

The number of young which Ophidians produce at a single deposition of eggs, differs considerably in the different species. I have observed in several Calamariæ not more than ten ; some Colubri lay from twenty to twenty-five ; I have found thirty and more in the Trigonocephalus atrox, and it is said that our Ringed Snake lays as many as forty. On opening the belly of a pregnant snake we see the eggs, impacted one against the other, and arranged in masses, occupying in all their length the oviducts, which then resemble a necklace. The embryon has all its teguments colourless, and the eyes extremely developed and salient ; the head is rounded, the muzzle short, sloping, and resembling that of a dolphin or of a fowl. In proportion as the fœtus is developed, so much nearer does its form approach to that of the perfect animal. To disengage itself from its prison, the young snake, probably by the power of its movements, ruptures the tunics which inclosed it. This operation it can easily perform when the coats are membranous, as in the viviparous species ; but it must require great efforts to burst the coriaceous envelope of the true egg : three or four longitudinal rents, near the end of the

* It is for this reason that some deny the existence of the allantoid in the eggs of the Ophidians, while others maintain the contrary : compare DESMOULIN's, *Mem. de la Soc. Med.* ; RATHKE, ap. ; BURDACH, *Phys.* ii., p. 409 and 563 ; HERHOLDT, *Oversigt*, &c.

† TIEDEMANN, *Jubelfeier*, p. 25.

egg, indicate the place at which the young serpent is to escape.*

DEVELOPMENT.

The *young*, on leaving the egg, usually differ from their parents, besides their size, by a system of colouring more vivid and more contrasted, by a head more blunt and more rounded, by the largeness of the eyes, and by the less perfect state of the epidermis and its appendages. They are, however, provided with teeth perfectly resembling those of the adult, of which they are ready to make use; and the venomous kinds, instructed by instinct with the power of their weapons, alternately elevate and lower their fangs, and defend themselves against attacks, with that fury which is innate in their race. It was long believed that the tail of the young was shorter in proportion to the trunk than in the adult, and that this member presented consequently in them a smaller number of subcaudal plates. If this were the case, we must suppose that new plates develope themselves with age; but as the number of plates corresponds to the number of vertebræ, we must equally suppose the production of new osseous pieces, as is seen in the Julus, —a circumstance little probable in animals so high in the scale of being as those of whom we treat. Besides, the researches which I have made on this subject have proved the contrary; since among a great many individuals, the young did not shew any difference from the adults in the number of plates, but what might be considered as accidental. To be sure of the fact, I have repeated these observations on a great number of the most dissimilar species, and have always obtained the same results.

Shortly after their birth, the young Ophidians undergo their first moult. This operation is repeated in our climate, according to the observations of Lenz, five times in the year, viz., every month from the end of April, to the beginning of September; whence it results that there is no cast-

* See, on what relates to the development of the egg of serpents, the excellent memoir of Professor Herholdt, illustrated by fine plates. *Oversigt*, 1829, p. 30, fig. 2.

ing of the skin during the hybernation. It would be very interesting to know how many moults serpents undergo in warm climates, where the state of sleep does not take place. A state of domesticity, a mode of life little natural to these animals, remarkably influences the functions of the skin, the epidermis of which does not renew itself in fixed and determinate periods ; frequently this operation is very long, and so painful that the animal suffers much, or it is some times followed by death. In order to reject the old epidermis, which bègins to detach itself at the head, and especially along the borders of the lips, the serpent passes itself through mosses, grasses, or heaths, and contrives, by means of slow and continued movements or frictions, to disengage gradually the exterior layer of the skin, which is already replaced below by a new epidermis. The spoils thus removed are found inverted from one end to the other, forming a sac with a reticulated surface more or less diaphanous, more wide than the body of the snake, because of the dilatation of the membranous intervals, and presenting, with the exception of those of the mouth and the nostrils, no other orifice than the anus ; for it is well known that the hemispherical membrane which protects exteriorly the globe of the eye, is part of the integuments, and comes off along with the rejected skin. This skin, at first soft, soon dries, and is easily preserved in cabinets ; but it is rare to find it entire, because it is often torn in the operation we have described. We possess some specimens of several foreign species, which prove that the moulting is produced in the same manner in all serpents.

The changes which Ophidians undergo, before they have acquired their full growth, have been as yet little studied. Thus, sometimes, as we have stated above, the livery of the two sexes presents considerable varieties at different periods of life. The males have often a more thick and longer tail than the females, probably because they have the organs of generation lodged in a cavity at the base of that member ; the females, on the other hand, acquire a size greater than that of the male, and their trunk is then of a more considerable volume. We are entirely ignorant of the age to which the different races of snakes arrive,

although it is generally supposed that they live long, as do all other reptiles; we are equally ignorant whether they have a stated period of growth, or what may be its duration. It is probable that they grow during the whole term of their lives, but my observations induce me to believe that this augmentation of volume takes place differently in the different periods of life, and that it is subject to the same laws which regulate the development of the greatest part of other vertebrate animals. The thick and rounded forms which distinguish the young serpent, disappear in the first months of its existence, and it becomes more elongated as it approaches the age of puberty. This term is fixed in our climate, according to M. Lenz, at the fourth year. It appears that after this period serpents increase less rapidly than in their earliest years, and that the development of their parts has rather relation to volume than to length; this age is marked by distinct traits, and the fulness of form. But before arriving at the close of their existence, the dimensions of ordinary serpents are sometimes doubled; the thickness of the parts, the obtuse and compact head, and the vigorous form, distinguish very aged individuals, that are, however, rarely to be met with.

Many travellers, and especially those of a more remote age, speak of serpents of a monstrous *size*, which they say they have encountered in their travels in intertropical countries, and which they state as reaching to forty feet and upwards.* In whichever country these great reptiles are found, they apply to them the name of Boa Constrictor, familiar to all, although the true boa constrictor of systems yields much in dimensions to other species of the Boa and the Python. The numerous researches of modern, well-informed, travelling naturalists, have belied many of the fables which have been promulgated on the nature of these Ophidians. We now know that the most gigantic do not surpass twenty to twenty-five feet in total length; that their thickness is not above seven inches in diameter; and that the received notions on the great size of some species, only repose on the vague surmises of the natives.

* See the article Boa, in Part II.

We must reckon in the first rank of all known serpents, in respect to its dimensions, the Boa murina, a native of the equatorial regions of America. The Python bivittatus, spread over intertropical Africa and Asia, is in the ancient continent the representative of that Boa, and attains nearly the same size. It is now found that the Python Schneideri, inhabiting India, has an elongated shape, and rarely surpasses fifteen feet in total length; the Boa Constrictor of the New World joins to an inferior length a very considerable thickness; as also do several other Boas, Colubri, &c. In our climate, serpents are rarely more than five feet in length, but in middle Europe there is one species of Coluber which arrives at the length of eight feet.*

HABITUDES.

Ophidians are spread over every country where the conditions necessary to the existence of reptiles in general are found. Every person knows that these cold-blooded animals love heat; that their number diminishes for this reason in proportion as we approach temperate or frigid regions; and that they prefer, on that same account, banks exposed to the heat of the sun, to elevated situations, or places covered with a thick and abundant vegetation. Yet there are, even with us, species common in the plains, which at the same time frequent the slopes of mountains, even at the height of several thousand feet above the level of the sea. Many Tropidonoti in Java abound on the solitary peaks of the numerous extinct volcanoes, with which that island is bristled. But by far the greatest number of Ophidians inhabit low lands, either naked or bosky, dry or humid, and marshy. Some are only seen in the vast sandy plains of the old continent; the analogous deserts of both Americas, known under the names of *Pampas*, *Llanos*, or *Savañas*, are peopled by other species, often spread over a vast extent of that continent. A great number of serpents frequent shady places, and often even occur in the thickest forests, sometimes concealed under luxuriant herbage

* *Coluber quaterradiatus*, the Boa of the ancient Romans.

or leaves, sometimes lost among mosses, lichens, or other parasitic plants. Many species are pleased with swampy places, because there they find an abundant subsistence suitable to their wants. Others frequent the vicinity of fresh waters, which afford them the means of subsistence, and a protection against the pursuit of their enemies; but these same species are sometimes found far from humid places, sometimes extended on a dry soil clothed with burnt up vegetation, and sometimes suspended from the branches of trees. The number of serpents which pass all their life in water is very small; and this mode of existence is especially natural to sea-serpents, which in vast shoals inhabit the most remote regions of our globe. Several species of serpents dig for themselves holes, which they never quit but to satisfy their wants; others establish themselves in the dens of small mammifera, which they sometimes drive out; some seek an asylum in the holes of trees, under their roots, near habitations, or even in houses, where sometimes a mass of dunghill or of dried leaves serves for their refuge; others make choice of fields or cultivated places, to give chase to the insects or small mollusca that abound in such places.

These observations demonstrate that many serpents prefer certain places only because they afford them subsistence, or because they unite all the conditions necessary to their existence. Thus, serpents are seen to desert their ordinary place of habitation when it ceases to furnish the means of subsistence. It is true, that this may perhaps be applied, with certain modifications, to all animals; but with this difference, that reptiles attached to the spot which gave them birth, do not understand how to undertake those long migrations which astonish us in birds and some mammifera. Most frequently land-snakes wander but a little way from where they are located, and we almost always find them so near their retreat, that they can gain it on the first approach of danger.

Many snakes live in society, and it appears that they do not mutually attack each other; such are most of the aquatic species, some of the genus Coluber, and notably

the sea-serpents, that shew themselves in immense shoals on the surface of the ocean. The venomous land-snakes, on the contrary, of which the number is infinitely more confined, seek less frequently the society of their kind, and keep themselves isolated in the midst of the solitudes they inhabit.

Serpents have among themselves various relations in their *manners* and *habits*. Almost all have a disposition stupid, timid, and wild; but when domesticated, they soon contract very mild manners, the venomous species always excepted, their intractable disposition preventing them from changing their ferocious character. Yet there are serpents, both venomous and innocuous, that scarcely ever make use of their weapons, except to defend themselves against aggressors; such, among the former, are the Hydrophis and the Elaps, among the latter, many Colubri, the Tropidonotus, and some others. This facility of being tamed is particularly natural to the larger species of the family of Boas, that after being captured never hurt any one.* Other species refuse to take any food, and become the victims of their obstinacy; but it would seem that by a treatment conformable to their necessities, it is possible to render captivity supportable to the majority of these reptiles.

The true venomous serpents, the burrowing snakes, and many species of other genera, have a very sluggish and tranquil disposition: thus their progressive movements are executed with slowness; but the majority of Ophidians are alert, and all their movements announce a surprising force and agility; their celerity has been exaggerated, which is never so considerable that a man cannot easily escape from them.

* M. Dieperkink writes me from Paramaribo, that he constantly keeps in his house several Boas of different species, that live in perfect harmony with each other, and other domestic animals. Professor Reinwardt, however, has witnessed at Java a spectacle which proves that it is not always right to trust to these animals. A Javanese had carried to the house of M. Van der Capelle a large Python, and wishing to make it come out of the basket in which it was, the serpent, by a single stroke, gave him a very considerable wound, laying open his forearm through all its length.

Serpents that lead a *nocturnal life* are less numerous than those that prefer daylight to darkness. To the first category belong the true Dipsas, several venomous Ophidians, and some others ; but several serpents combine both kinds of life, and sometimes hunt their prey in daylight, sometimes in the night, according to their necessities. We must arrange in this last class the species which have an elongated pupil, either vertical or transverse, which seems more particularly adapted to contract or to dilate, according to the intensity of the luminous rays which it is necessary to receive into the cavity of the eye. In obscurity, the pupil thus formed so dilates itself, as to be entirely orbicular.* The law, admitted by most naturalists, that animals with an elongated pupil are more especially nocturnal, is contradicted by these observations ; it seems rather that voluminous eyes indicate a nocturnal kind of life, although several of the genus Elaps and Naja, that have very small eyes, search for their prey during the night. Perhaps it is wrong rigorously to apply this rule to the manner of life of snakes, of which a good number pass a great part of their existence in a state of languor, or listlessness resembling sleep, and that do not disturb themselves, unless when some animal approaches them, which they seize when they are inclined, relapsing afterwards into a profound lethargy, which renders them sometimes for a considerable period incapable of hunting for food.

Most Ophidians choose their food indiscriminately from among the three first classes of vertebrate animals. The aquatic species live more or less exclusively on fishes, according as their mode of life devotes them to the liquid element. The species of small size, especially the terrestrial and burrowing snakes, pursue insects, mollusca, worms, or other animals of the lower classes. Tree serpents prefer birds, not because this species of nutriment is better suited to their taste, but because it is more within their reach.

Every body knows that serpents can, like other reptiles, fast for a long time. A Boa constrictor sent from Surinam to Holland was more than six months without the least nou-

* HARLAN, Synopsis, p. 369.

rishment; sometimes they have been still longer before dying of starvation.*

We are ignorant whether serpents drink, and it is probable they do not, no fluid having been found in the stomachs of these animals on dissection.

The continual changes of our atmosphere operate more or less powerfully on serpents. Fond of heat, they eagerly search for places exposed to the rays of the sun, whilst they remain concealed during rain, or in windy weather: at the approach of a storm, when the atmosphere is charged with electricity, they are often seen to leave their retreats, in a state of agitation not natural to their kind, and to pass over open places. Unable to support the effects of cold, which, at the same time, deprives them of food, serpents retire on the approach of winter into retreats, most frequently subterraneous, and always secured against the inclemencies of the weather; these are sometimes in burrows, or in heaps of stones, sometimes in dunghills, or in the hollow of a tree. In such situations, many are often found together in the same place of retreat, in a profound torpor, until the vivifying rays of the sun reanimate them in the spring. It is obvious that the duration of this periodic sleep should be longer or shorter according to the climate which the serpents inhabit; and that in a region in which there reigns a perpetual spring, these reptiles are not liable to pass a certain time in this torpor. The researches of travellers have shewn that this is a fact; but there are some exceptions to that law, which leads to the supposition, that defect of food is the cause of this torpor. M. Von Humboldt† states, on the information of the natives, that the Boa murina, during the long rains that inundate the immense deserts of South America, remains buried in the argillaceous soil, until the mud, dried by the heats which immediately succeed the rainy season, cracks to let out the monstrous reptile from the tomb which inclosed it. In Surinam, Brazil, and other districts of South America, inhabited by this boa,

* [The translator knew of two rattlesnakes living 18 months without swallowing any food.]

† *Ansichten*, i. p. 35.

it passes, on the contrary, like the other serpents, the whole year in a state of continual activity.*

In our climate, and in North America,† serpents retire into their winter retreat toward the month of October, and reappear about the end of the month of March or April, later or sooner according to the greater or less rigour of the winter. The thick layers of fat with which their intestines are lined in autumn, are absorbed in a great measure during their torpor, and it is some days before they have recovered their strength in the spring. An excessive cold kills them, whilst several fine days in succession often suffice to make them leave their retreats in the middle of winter.

It is still to the work of M. LENZ‡ that we must refer for the detailed statement of the observations which this naturalist has made, to discover the effects which cold exercises on these reptiles.

FABLES AND PREJUDICES.

The serpent performed a grand part in *antiquity*, and still plays it among most barbarous or demi-civilized nations. Numerous causes have been assigned for this phenomenon. Man intimidated by his aversion for these animals, which is in him in some degree innate, has only learnt from experience, how small a number of these reptiles are formidable by their poisonous qualities, while others conceal under the same delusive appearances, a mild and inoffensive character.

A thousand different properties, which are successively detected in serpents, have opened to man a vast field of meditation, and, in furnishing ample materials to dress out his religious ideas, have presented him with an infinite number of mythic allegories. He has drawn from them symbols, and has ended in offering to those dreaded animals a worship founded on the most diverse and conflicting motives. It would seem to be natural to man to avail himself

* NEUWIED, *Beitr.* p. 11.
† PALISOT-BEAUVAIS, Ap.; LATREILLE, iii. p. 4. ‡ P. 57.

even of the animals which are noxious, for procuring the means of preservation from the evils which they cause: hence the practice, established from the most remote times, of extracting from serpents remedies against their bites; while, on the other hand, man sought to appease their fury by revering them as divinities. The ancients, employing often the most prominent characteristics of animals in their allegories, discovered in the habits of serpents, in their qualities, or even in their form, an inexhaustible fund for setting to work their own fertile imagination, which heated itself invariably in embellishing the observations they had made from nature. It is to these various causes, and to circumstances perhaps little known at this time, that we should attribute the fear, mingled with hatred and veneration, with which the serpent has inspired the human race.

In the mythology of most ancient nations, there are traces which attest that the idea of the serpent as the *evil principle* prevailed from the most remote antiquity. The serpent is represented as the cause of the first transgression and fall of man; and Arimanes, assuming the form of a serpent, seeks in vain to overcome his antagonist Orosmandes, who represents the good principle in the idealism of the ancient Persians.

It is believed that the ancient Greeks made choice of the allegory of the great serpent killed by the arrows of Apollo to represent the pestilential vapours, emanating from the marshy slime which covered the earth after the deluge, or after annual inundations, and which could only be dissipated by the rays of the sun; afterwards, this Python became the attribute of Apollo and his priestesses at Delphi, and it subsequently served for the emblem of Foretelling and Divination. Analogous circumstances probably gave rise to the fable of the Lernæan Hydra, exterminated by the labours of Hercules and his companion Iolas. Among the ancient Egyptians, the serpent was the symbol of Fertility. They represented under the form of a serpent, inclosed by a circle, or entwined around a globe, the Cneph of their cosmogony, who is the same as Ammon, or the Agathodemon, the spirit or soul of creation, the principle of all that

lives, who governs and enlightens the world.* The priests of that people kept in the temples living serpents; and when dead, interred them in those sanctuaries of superstition.†

As an emblem of Prudence and of Circumspection, the serpent was the constant attribute of Æsculapius, and the same veneration was paid to those reptiles, as to the father or the God of medicine and magic.‡ The Ophites were Christian sectaries, who, towards the second century of our era, established a worship which was particularly distinguished from that of the Gnostics in this, that they adored a living serpent; conforming themselves to the ancient traditions of their race, they regarded that animal as the image of Wisdom, and of the sensual emotions which it awakens.§ The monuments of the Mexicans, of the Japanese, and of many other nations who owe the foundation of their civilization to the ancient inhabitants of Asia, attest that the serpent played also a part more or less important in their religious mysteries; but time and the relations which exist between those nations and Europeans, have partly abolished these usages; and at this day it is only among negro tribes, and on the west coast of Africa, that the serpent figures among divinities of the first rank.‖

It does not enter into the plan of my work to explain or even to allude to the numerous allegories which the serpent represented among the ancients. Every one knows that the snakes armed the hand of Discord, no less than the whip of the Furies, and that the head of the Eumenides bristled with serpents; the two snakes twisted around the caduceus of Mercury is the type of insinuating eloquence; the circle formed of a snake biting its own tail, without beginning and without end, was the chosen symbol of eternity; the celerity of movements uniformly repeated to execute progressive motion, became the emblem of the swiftness of time,

* Eusebii, *Pred. Evang.*, 33; Horopollo, ap. i. 2; Creutzer, *Symb.* L. i. 507 and 824.

† Ælian., xvii. 5; Herodotus, ii. 74.

‡ Pausanius, ii. 26–28.

§ Mosheim, *Gesch. der Schlangenbr.* p. 1.

‖ See our article on the *Python bivittatus*.

and the succession of the infinity of ages; the fables, lastly, of Achelous, of Jupiter metamorphosed into a serpent to captivate the object of his love, and many others, attest that the ancients attributed to the serpent qualities the most opposite, and that the same being, according to them, united at the same time force with timidity, beauty with a shape which inspired horror, mildness with cunning or deceit.

We ought to attribute to causes similar to those we have mentioned, to that superstition—an inheritance of human nature—the innumerable errors which, even to our times, have disfigured the history of serpents. A vast number of those fables, invented in the infancy of the human race, and transmitted to posterity by classic authors, are spread abroad so as to acquire popularity from the authority which is accorded to those writers. To prove this assertion it is sufficient to recollect what several modern authors have repeated in their works, that hogs kill snakes to feed upon them, and that serpents find in milk a great dainty; errors which date from the times of Aristotle* and Pliny,† but propagated in Europe, in America, and other parts of the world. We read in the same authors,‡ that the ichneumon, to defend itself against the bites of snakes, bedaubs itself with mud, and that it eats a certain herb which those reptiles hold in aversion. This prejudice, which rests on the simple fact that the little mammiferæ we speak of, as well as many others, are the natural enemies of serpents, is preserved in various parts of the East Indies. The plant which possesses the virtue of repelling snakes, according to Kæmfer,§ is the *Ophiorhiza Mungos*, according to others, the *Aristolochia indica*, which the jugglers of those countries pretend to use with success; but the experiments of Russell‖ have demonstrated that all these qualities repose only on popular prejudices. The same holds good with regard to the employment of the *Polygala Senega*,¶ a plant

* *Hist. Anim.*, ix. 2.
† *Hist. Natur.* viii. 14.
‡ Aristotlis, ix. 7. Plin., viii. 36.
§ *Amœnitates Exoticæ*, i. p. 305.
‖ *Indian Serpents*, i. p. 86.
¶ Palisot Bauvais, Ap. Latreille, iii. p. 90.

celebrated among many tribes of North America; while other nations reject it, to make use of plants of the genera *Prenanthes*, *Lactuca*, *Helianthus*, *Spiræa*, &c., the efficacy of which, as antidotes against the poison, are as little proved as that of the former. Modern travellers of great name have furnished some curious facts relating to a plant,* to which the inhabitants of Colombia attribute the same qualities as those ascribed to the Aristolochia in India; but it is much to be desired that these experiments were repeated by persons familiar with the nature of serpents.† It will be superfluous to repeat all that the ancients have invented concerning the innumerable antidotes of which they vaunt the efficacy. On consulting the passages of PLINY‡ to which we refer, it will be seen that the ancients recommend indiscriminately, for this purpose, the most heterogeneous substances; but that the attempts which they made were the result of the grossest empiricism. Deceptions of this nature are practised in India and Ceylon, where they sell pastilles and pills of different kinds, arbitrarily composed of substances from the vegetable, animal, and mineral kingdoms, and which merely act on the imagination of the sufferer.§

We have stated above, that the practice of extracting from serpents the remedies against their bite, dates from remote antiquity: Antonius, physician to Augustus, employed vipers in several diseases;‖ but it was not until the time of Nero, when the physician Andromachus of Crete,¶ invented the *theriaca*, that the practice became general. The theriac was an arbitrary compound of heterogeneous medicaments, and was afterwards employed in maladies of the most opposite nature: it was compounded in the middle ages in almost all the cities of Europe, particular-

* *Plantæ Equinox*, ii. pl. 105.

† [The author perhaps is not aware of the curious experiments on the rattlesnake with the leaves of the *Fraxinus Americana*, by Judge Woodruffe, published in Silliman's Journal for 1833.—*Tr.*]

‡ *Hist. Natur.*, 28, 42, 29, 15, 17, 20, 21, 22, 25, 26, 32, 17, 19, &c.

§ RUSSELL, i. p. 74; DAVY, *Ceylon*, p. 100.

‖ PLIN., 30, 39.

¶ GALEN, *de Antidotis*, lib. i. cap. 6.

ly in its southern parts: at this day, the practice of including the snake in the composition of this medicament is only retained in Italy, where the theriac is still made in various places. In Sicily it is prepared at Palermo. That of Venice is very celebrated: there they use millions of the Vipera aspis, which is common in the vicinity of that city.* The great manufacture of theriac which exists at Naples, under the protection of the government, is a private speculation, at the head of which stands the learned Professor Delle Chiaje; there they use indiscriminately every species of serpent, although they prefer the vipers named *viperiere* by the peasants, who bring them alive in baskets. M. Siebold assures me that they frequently employ a species of theriac in China and Japan; the inhabitants of the Lioukiou Isles extract medicaments from the Hydrophis colubrina; and at the Isle of Banka, the Chinese reckon the bile of the Great Python a precious remedy against many diseases.† I pass over the use made in the middle ages of different parts of the snake, to each of which was attributed salutary qualities; in our days they are wholly laid aside.

It is only in recent times that those experiments have been instituted on the effects of the bites of snakes, which we have related elsewhere: the ancients, as many people still do, reputed indiscriminately all serpents venomous; they placed the seat of their deadly weapon in the tongue, or in the end of the tail, and ascribed to the bite of each species, according to their fancy, a different train of mischiefs.‡ Civilization is unable to destroy these errors, and one is astonished to hear them repeated by well-informed persons; to see republished in several works the story of the three sons of a colonist, successively dying at long intervals, of a wound caused by the fang of a rattlesnake remaining in the boot of their father, who had first died of the bite: a story which the inhabitants of Surinam, as well as those of the United States, are

* MS. note communicated by the late Dr Michahelles.
† Olivier, *Lund en Zeetogten*, ii. p. 447.
‡ See Lucan, *Pharsalia*, ix. 937; Nicander, *de heriaca*.

pleased to repeat to strangers passing through their country. One is astonished to hear of sea-snakes of monstrous size ;* of boas from forty to fifty feet long that attack men, oxen, tigers, and swallow them whole, after having covered them with a frothy saliva :† absurdities that bring to recollection those fables of winged monsters or dragons, of which the mythology of the ancient people of Asia has preserved the remembrance, and of which the wayward fancy of the Chinese has multiplied the forms. What shall we say on reading in modern works of great reputation, descriptions of the marvellous effects produced on serpents by music ; when travellers of talent tell us they have seen young snakes retreat into the mouth of their mother, every time that they were menaced with danger ! Unfortunately naturalists, in classing such fables with the number of facts, have often embellished with them their descriptions, and thus have contributed to give them universal acceptation. Who, for instance, will not be struck with the description which LATREILLE and LACEPEDE have drawn up of the habits of the boa, and of other serpents of great size ! How many qualities have not these philosophers attributed to those beings, which have never existed, except in their own imaginations !

Every one has heard of the pretended magic power which serpents are said to exercise over small animals, when they wish to catch them : there are few works on natural history which have not treated of this phenomenon, contradicted by some, and defended by others, without their being able to arrive at a satisfactory conclusion. I shall not here repeat the absurdities which travellers have written on this head, and which are sometimes extremely curious :‡ suffice it to say, that these tales, of which the traces may be found in several classic authors,§ are particularly in vogue in North America, while they are unknown in the East Indies and in Europe, countries rich in serpents of every species. This observation is too

* See the article *Hydrophis* in the descriptive part of my work.
† See the article *Boa*.
‡ See LEVAILLANT, 2de Voyage, i. p. 93 ; BARROW, Trav. p. 120.
§ ÆLIAN, ii. 21 ; POMPONIUS MELA, i. 19.

curious not to merit some attention, as it shews how a fact, true or supposed, may be so spread as to become popular. Many causes might have given rise to the origin of the pretended *power of fascination* of serpents. It is true that most animals appear absolutely ignorant of the danger which menaces them, when they find themselves in the presence of enemies as cruel as serpents; we often see them walk over the bodies of those reptiles, pick at their head, bite them, or lie down familiarly beside them: but we need not also deny, that an animal, unexpectedly surprised, attacked by so formidable an adversary, seeing his menacing attitude, his movements performed with such celerity, may be so seized with fear, as, at the first moment, to be deprived of its faculties, and rendered incapable of avoiding the fatal blow, which is inflicted at the moment when it perceives itself assailed. Mr Barton Smith, in a memoir expressly written to refute all that has been advanced on the fascination of the rattlesnake, relates several instances which prove that birds do not shew themselves afraid, except when the serpent approaches their nests to seize their young. Then one may see the terrified parents fly around their enemy, uttering plaintive cries, just as our warblers do when any one stops in the vicinity of their nests. It may also be, that the animals which it is pretended had been seen fluttering around the snake, and at last falling into his mouth, have been already wounded by his poison-fangs; a supposition which perfectly corresponds to the way in which venomous serpents master their prey. Many tree-snakes seize their prey by twisting their slender tails around their victim: Dampier* has several times been a witness of this spectacle: observing a bird flapping its wings, and uttering cries, without flying, this traveller perceived that the poor bird was locked in the folds of a snake, when he attempted to lay hold of it. Russel† presented one day a fowl to a Dipsas, and the bird in a short time gave signs of death; not conceiving how the bite of a snake not poison-

* *Voyages*, iii. p. 275.

† Russel, i. p. 20.

ous, and so small, could produce such an effect, he carefully examined the fowl, and found the folds of the tail of the snake around the neck of the bird, which would have perished had he not disengaged it. Many birds of small size are accustomed to pursue birds of prey, and other enemies of their race, or to fly about the place where the object of their hatred lies concealed: there is reason to believe that this phenomenon, known in Europe to every observer, also takes place in exotic regions; and perhaps this is also one of the circumstances which have contributed to the invention of the stories which have been related of the power of fascination in serpents.

But I have too long interrupted the progress of my work, in exposing the numerous errors which have disfigured one of the most beautiful parts of natural science; and I believe I ought to omit the fables concerning the basilisk, the hybrid snakes produced by the congress of eels and serpents, and the other tales as strange as absurd, which are still believed by many persons. Yet, before terminating this division of my work, I shall notice the magic power which certain persons pretend to be able to exercise over snakes. This pretended art, which formed at all times, and among various nations, the occupation of a particular caste, consists in certain tricks which the serpents execute at the will of the *conjurors*, who have trained them expressly for the purpose: as they chiefly make use of the Naja tripudians and Naja haje, I have, in these two articles, stated the manner in which they employ serpents in those tricks.*

Such conjurors exist now in the Indian Peninsula, and in Egypt;† those of the latter country boast themselves to be the descendants of the Psylli,‡—a tribe who inhabited ancient Lybia and India, and were celebrated for their

* [The author here alludes to the descriptive part of his work, not yet translated.]

† Geoffroy, *Descrip. del Egypte.*, xxiv. p. 88.

‡ Plin. vii. 2; Ælian, 16, 37, 17, 27; Lucan, ix. 891. Consult also the paper of Mr Spalding, entitled *Uber die Zwaberei durch Sehlangen*, and inserted in the *Memoires de l'Academie de Berlin*, 1804–11, classe Historico-philosphique, p. 9.

skill in curing the bites of snakes, and securing themselves against them. Another people inhabiting Italy, but less known, were the Marsi;* we know still less of the Ophigenoi, whose country was Greece.†

Among the more civilized people of Europe, persons who pretend to possess the art of fascinating serpents, are very rarely to be met: they consist most frequently of ignorant charlatans, who impose on the lower orders, seeking to alarm them by playing familiarly with serpents, while they are only thus familiar with the innocuous. M. Lenz has given in his work‡ the history and tragic end of one of those pretended conjurors, who paid with his life for a temerity, founded on absolute ignorance of the nature of vipers.

HISTORY OF OPHIOLOGY.

In tracing, in the following pages, a succinct history of Ophiology, we shall confine ourselves to a notice of the principal authors who have more particularly contributed to the progress of this branch of natural history, considered as a science.

The first indications of this nature are to be found in the pages of Aristotle: it appears from his observations, that this great man made very exact researches on the nature and anatomy of snakes;§ but, unfortunately, his work is disfigured by many prejudices, fashionable in his day, which he repeats with perfect good faith: this author does not enumerate the species, and speaks but vaguely of the aspic, of the viper, and of serpents in general.

The great compilation of Pliny is more rich in curious but erroneous statements, than the work of the Greek philosopher of which we have spoken: he omits most of the anatomical details given by Aristotle, but he makes mention of the principal species known at that time, and

* Virgil, *En.* vii. 750; Silius Italicus, viii. 495.
† Plinius, vii. 2; Ælian, xii. 39.
‡ Page 192.
§ ii. 12; iv. 11; v. 3; v. 28; viii. 17 and 19, &c.

proves, by his description of the fangs of the viper,* that the true seat of the poisonous organ was not unknown to the ancients.

ÆLIAN still surpasses his predecessors in the great number of errors which he details with regard to the manners of serpents; of which he describes several species, and most frequently copies their descriptions.

Other classic authors, such as NICANDER, VIRGIL, LUCAN, &c., speak, in their works, more or less directly, of serpents, of their qualities, and of the effects of their bite; but these poetic productions have contributed little to advance the knowledge of animals, of the true peculiarities of which the ancients were ignorant.

The Greeks indiscriminately comprehended all serpents under the general denominations of *δραχων* and of *οφις*, derivatives from the verbs *δερκειν* and *οπτειν*, both of which signify to *see*. The first of these appellations has been adopted by the Latins; but that people also employed the general names, *anguis* and *serpens*, to denominate Ophidians. The German word *Schlange*, from *Schlingen*, has an etymology analagous to the Latin *serpens*, from *serpere*, whence the French have formed their words *serpent* and *serpenter*. Many other names in use among the ancients appear to have been very vaguely applied, although in a sense very general. ÆLIAN,† for example, enumerates 16 species of *Aspis*, while it appears from passages in other writers, that the *Aspis* was the Naja haje.‡ It is not possible to determine positively the species of Ophidians known to the ancients, because of the incomplete descriptions which they have left us; therefore it is not without hesitation that I hazard conjectures on this subject. But here they are: The manners which PLINY§ and ÆLIAN‖ attribute to the *Jaculus* coincide perfectly with those of the Coluber flavolineatus; the *Amphisbæna*¶ of these authors is probably identical with our Eryx; the etymology of the word *Cerastes*** proves that it is still the same

* L. cap. xi. 62.
† L. c. x. 31.
‡ NICANDER, *in Theriac*; LUCAN, 9, 695; PLIN. 8, 35.
§ L. c. 8, 35.
‖ L. c. 6, 18, 13.
¶ PLIN. 8, 35; ÆLIAN, 9, 23.
** PLIN. 8, 35.

serpent which we know under this name; CUVIER supposes, with reason, that the *Boa* of PLINY* is but a great Coluber of Italy, probably the Coluber quaterradiatus. I have reason for believing that our Vipera Echis, the head of which is often ornamented with a white spot, has served for the type of the Basilisk of the Cyreniaca described by PLINY;† it is supposed that the Hydrus of the Roman naturalist‡ is founded on our Tropidonotus Natrix; but ÆLIAN,§ under the name of sea-snake, has incontestably described the *Dipsas;* lastly, the *Paria*, and other serpents, of which classic authors make mention, are too vaguely indicated to be referred to their types.

Those who seek for more detailed information on the knowledge which the ancients had of serpents, have only to consult the works of the learned GESSNER, who has also collected in his work all the fables which have been written on these animals in the middle ages. We omit such observations, of very little real interest to science, which can never acquire solidity through such works as those of ALDROVANDUS and JOHNSTON—complications made without taste and without genius, and in which one sees repeated the innumerable errors of their predecessors, whether it be the prejudices which have disfigured the history of Ophiology, or the description of those chimerical beings named *Dragons*, which those learned persons have not failed to illustrate by figures.

RAY was the first who essayed to give a sort of classification of serpents; but his system, founded on an insecure basis, has been long abandoned. It was not till the following century that the Natural History of Serpents, by his countryman OWEN, appeared—a book written without judgment, and abounding in erroneous and fabulous stories.

Several delineators of objects of natural history, about the same period, distinguished themselves by the publication of collections of figures more accurate than had been furnished by their predecessors. We ought to cite, in the

* PLIN. 8, 14.
† PLIN. 8, 23.
‡ L. c. 29, 22.
§ L. c. 16, 8.

first place, SCHEUCHZER, who has given, in a voluminous and heterogeneous work, a considerable number of uncoloured figures of serpents, the most of which, though not above mediocrity, are sufficiently recognisable. SEBA, who has surpassed all iconographists by the great number of the figures which we owe to his care, has represented in the first two volumes of his work, the snakes which made a part of his own museum, one of the richest of that age: many of his figures are very faithfully rendered, others are passable, some very bad; but the greatest number are so oddly coloured, that it is difficult to recognise the animal which has served as the model. This author does not appear to have had in view any other object, than to exhibit in his work the whole of that innumerable series of specimens which adorned his cabinet—the figures are there accumulated without selection or judgment; the same serpent is there often represented ten or more times; and these different portraits of the same animal sometimes offer very little resemblance, because the artist has disfigured each of them. The text, which accompanies these plates, abounds with errors and false information respecting the native country of the animals and the names of places; it is very evident that SEBA has done little but reported the stories of sailors, whose avidity invented lies to profit by his credulity. Instead of tracing in a few words the essential characters of the animals figured, this author often dwells on the description of a trifling point, of a spot, or of some other insignificant mark—a circumstance which renders the explanatory text absolutely useless. However, this immense collection has furnished materials to many naturalists; it has been, even to our times, a rich mine, which is incessantly dug, and from which many philosophers have extracted information, of which they have afterwards availed themselves in the composition of their works.

The Natural History of Florida by CATESBY, published about the same period, is still more useful for a knowledge of the productions of that country, which has not since been explored by any traveller, with the same view. The figures

which it contains are, for the most part, passable ; but many among them are given with very little accuracy.

A considerable number of figures of serpents, very recognisable, are to be found in the Museum of Prince ADOLPHUS FREDERIC, published by LINNÆUS, which appeared before the last editions of the *Systema Naturæ*. The author himself quotes a second volume of this work, in which he has been followed by his successors, although that volume never was published. To this great man, the inventor of the Dichotomic method, we owe the first sketch of a true classification of Ophidians :* these animals formed his second tribe of the order of Reptiles, which he thus characterizes, "*Serpentes, apodes, spirantes ore.*" The six genera established by him are founded on characters taken from the organization of the general integuments. If we take away the genera Amphisbæna and Cæcilia, which make a part of the Linnæan family of Ophidians, there remain only the Crotalus, Boa, Coluber, and Anguis, distinguished by the form of the plates below the body. The first genus comprehends all those serpents which have the tail provided with the noise-making apparatus, known under the designation of the *rattle ;* the Boa is distinguished from the Coluber by entire subcaudal plates ; the Anguis has below plates similar to the scales on other parts of its body. It is obvious, that a method founded on characters, so fugitive as those of which LINNÆUS availed himself for his system, must contradict nature : thus all the natural affinities that connect the different species of Ophidians are dissevered in his species. We there see the Trigonocephalus by the side of the Boa ; his genus Anguis includes at the same time the Scinks, the Tortrix, the Typhlops, the Hydrophis, and the Ophisaurus. The other serpents are referred to his genus Coluber, in which are jumbled the Vipers, the Pythons, the Calamars, the Najas, the Homalopsis, the Dipsas, the Dryiophis, &c. &c.

All the successors of LINNÆUS having in some shape followed his method, which they may be said merely to have

* *Syst. Naturæ*, Ed. xii. p. 347.

extended, allowing themselves to be guided by the same principles, and are hence unable to follow a natural system. We shall see in the sequel to what errors this manner of viewing the subject has given rise, and on what a false path it has conducted.

KLEIN,* most frequently guided in his labours by a spirit of contradiction, has arranged among serpents many Annelides, and even Intestinal Worms. The true serpents are by him divided into two classes, characterized by the form of the head and of the tail: those with the head of the same diameter with the body, and with a short and rounded tail, form his genera Amphisbæna and Scytale; the other class comprehends the Kynodons or venomous snakes, in which he distinguishes the Viper, the Naja, and the Crotalus; the innocuous serpents are lastly distributed into the genera Ichthyodon, Lytaidon, and Anodon, established on the form of the teeth.

It is obvious that this author is the first who has proposed to separate the venomous from the innocuous serpents. It was afterwards that GRAY† especially devoted himself to discover the marks by which to characterize these two divisions. The result of his researches is, that there is no other method of recognising the venomous species, but by ascertaining the presence of the fangs. This memoir contains many good observations on the dentary system of serpents.

The great reputation that LAURENTI acquired by the publication of his synopsis‡ is not less than his merits as a systematic author. His third order of Reptiles comprehends the serpents, which he distributes into the genera Chalcides, Cæcilia, Amphisbæna, Anguis, Natrix, Cerastes, Coronella, Boa, Dipsas, Naja, Caudisona, Coluber, Vipera, Cobra, Aspis, Constrictor, and Laticauda. The numerous species with which he has enriched his scheme, being, for the most part, established and characterized on the figures of Seba, are chiefly nominal, as may be seen in analyzing

* *Tentamen Herpetologiæ, Konigsbergi*, 1755.

† *Phil. Trans.*, lxxix., pl. p. 21.

‡ *Synopsis Reptilium*, Vienna, 1768.

his genera Naja, Boa, and Constrictor ; on the other hand, it is only necessary to examine his genera Natrix, Cerastes, and others, to be convinced of the little certainty which pervades his views relative to the characters which he assigns to distinguish his artificial divisions.

The order of Serpents, as it exists in the edition of the *Systema Naturæ* published by GMELIN,* differs not from that of his original author, but in the addition of species described by naturalists and travellers to that period.

It was almost at the same time, that the work of DAUBENTON† on Reptiles appeared in the form of a dictionary ; a book now rarely consulted, although it is the basis of those of LACEPEDE and BONNATERRE.‡

In the great work of Count LACEPEDE, the Serpents compose a fourth order of the class of Reptiles, distinct from the three first, which form those of Oviparous Quadrupeds with a tail, without the tail, and the Oviparous Bipeds. In adopting the six genera of serpents devised by LINNÆUS, the continuator of BUFFON added the Langaha and the Acrochordus, after the descriptions of BRUGUIERES and of HORNSTEDT ; for it was not until fifteen years afterwards that the genera Erpeton, Leioselasma, Disteira, and Trimeresurus, were established. The work recommends itself by the beauty of the style, which is poetic in some parts, although the statements which make the basis of the reasonings are not always in accordance with fact ; the descriptions, more lengthened than those of his predecessors, rarely sin against minuteness, but they are far from sufficing for a rigorous determination of species. The figures which serve to illustrate this work are scarcely above mediocrity, and are sometimes even very bad.

It was not more than ten years after the publication of the Natural History of Reptiles of LACEPEDE, that a German translation of it appeared from the pen of the cele-

* LINN. *Syst. Naturæ*, Ed. 13. GMEL. *Lips.* 1788.

† It forms a part of the *Encyclopedie Methodique*, of which the first volume appeared in 1782.

‡ *Encycop. Med. Paris*, 1802.

brated BECHSTEIN. This philosopher, unskilled in that branch of science, has drawn together, in this translation, all that was known in his time on Reptiles, and has caused to be engraved a great number of the figures of SEBA, of RUSSELL, of MERREM, and others; I have occasionally quoted this compilation, in which BECHSTEIN has introduced some very good original observations on the indigenous Ophidians.

The classification of reptiles proposed in 1799 by M. ALEX. BRONGNIART, is founded on their general organization, and rests on principles too solid not to have been adopted by naturalists. It is to this savant that we are indebted for the introduction of the four orders now generally recognised; but as he defines Ophidians to be animals without feet, with the body enlongated, and cylindrical, it is obvious that the Anguis and Cæcilia are not excluded from that order. BRONGNIART has further introduced the genera adopted by LACEPEDE, and augmented it by the addition of the genus Vipera, which comprehends many venomous snakes.

SCHNEIDER, treating the natural sciences as a man of letters, has created the genera Hydrus, Pseudo-Boa, and Elaps, to class in them serpents of very heterogeneous kinds. We see figuring in the first, by the side of the true Hydrophis, the Acrochordus, and the Tropidonotus, while the two last genera present a confused medley of snakes very different from each other.

It is difficult to comprehend why LATREILLE has preferred to the classification of BRONGNIART a method analogous to that of LACEPEDE. In glancing over the work which he has published, and which is ornamented with pretty figures in miniature, but without any scientific interest, one perceives that this learned entomologist, in the composition of his work, has almost exclusively employed the materials furnished by SEBA and LACEPEDE, and also some remarks supplied by travellers. He has, however, extended the list of his genera, by creating those of Scytale, Heterodon, Platurus, Hydrophis, Enhydrus, and in establishing subdivisions in those of Coluber and Vipera.

The second part of the third volume of the *General*

Zoology of SHAW, published in 1802, contains the description of serpents. This work, in every part, affords but a crude and steril compilation; the new species which the author makes known are very few in number. It appears that SHAW described the sea-serpents from specimens brought home by RUSSEL.

The most complete work which has yet appeared on Ophidians, is that of DAUDIN: it forms a part of his Natural History of Reptiles, published in 1802, and the following years. The author has followed the method of BRONGNIART, but the formation of several new genera is due to him. After the example of RUSSEL, he has separated the Pythons from the Boas;' his genus Bungarus has not to this time sustained any alteration; that of Vipera comprehends with him most of the venomous snakes properly so called; his genera Lachesis, Hurriah, Eryx, &c., have been rejected by me, while of the others, the Coralla and Cothonia have never been adopted by naturalists. The descriptions of DAUDIN are generally very minute, but he is deficient in solid elementary knowledge, and is ruled by a spirit of contradiction. This author, little skilled in criticism, often commits very grave errors. The figures which adorn his work are superior to those of LACEPEDE; but, reduced to too small a size, most of them are deficient in correctness. DAUDIN has availed himself of numerous materials furnished by the iconographs of MERREM and RUSSEL, published in part before the period when he wrote.

The first of the works which we have just mentioned, the Beiträge de MERREM, contains figures of serpents, easily recognisable, and accompanied by good descriptions. The second is the most extensive and richest collection, which has ever appeared to illustrate that part of a fauna which treats of Ophidians. The portraits which it contains, especially in the second volume, are for the most part very accurate, although the artists may be charged with neglect of the numerous means which modern art possesses, and of which the French delineators know so well how to avail themselves. We owe to RUSSEL many excellent remarks on the habits of serpents; the experiments which he made on the effects of the bite of those animals merit quotation; hence his suc-

cessors have taken care to make extracts from him in their works.

Of all the figures which have appeared to this day on the natural history of animals, those which are found in the *Grand Work on Egypt* are beyond dispute the most perfect, for the fidelity with which the subjects are reprerented. The explanatory text of these plates has only been recently published, and still only comprehends the first part; the objects represented in the supplement by Savigny having been lost.

A novel classification of reptiles, at first inserted in the *Annals of Natural Sciences*, has been separately published at Munich in 1811. The author, the late M. Oppel, differs much from his predecessors. In adopting the four orders established by Brongniart, he has introduced numerous modifications; as in reuniting the Saurians and Ophidians, as subdivisions of his order Squamata; in arranging the Anguis among the Saurians, and placing, according to the remarks of M. Dumeril, the Cæcilia in the order of Batrachians. This system, more natural by its connection than any other published, has only been appreciated in our days. We owe to the late Oppel the establishment of several very natural genera, such as Tortrix, Trigonocephalus, Vipera, &c.; but he has introduced confusion into the system by reuniting the Bungarus under the general denomination of Pseudo-Boa, while he applies the first name to the Dipsas. The seven families which he has created for the subdivision of Ophidians, are founded on too small a number of observations to be useful at this time of day. Some are even very little natural; for example, that of Pseudo-Vipera, comprehending the genera Acrochordus and Herpeton; and the Viperinæ, in which the Vipera, Bungarus, and Naja, &c. are united.

I now arrive at the labours of Cuvier on Serpents. Founded on observations first inserted in his Comparative Anatomy, this illustrious philosopher published, in 1817, a classification of serpents* of which we shall give a sketch: it was reproduced in a second edition, and has undergone

* *Règne Animal*, vol. ii. ed. 2le.

no essential change, except the introduction of some new genera ; on this account, we shall make our extracts from this last work. Cuvier having classed in the order of the Ophidians all reptiles without feet, it follows that beings of an organization different from that of serpents, such as the Anguis, the Pseudopus, the Cæcilia, should enter into its formation. The first family, that of Anguis, comprehends the genera Anguis, Pseudopus, Ophisaurus, and Acontias. The second family, that of true serpents, is divided into two tribes :—That of the double marchers, containing the genera Amphisbæna and Typhlops ; and that of the serpents properly so called, embracing all the rest of the Ophidians, is divided again into two sections. First come the innocuous serpents, distributed into the genera Tortrix, Boa, Coluber, and Acrochordus, genera which may very well be called families, and of which the majority are composed of several very natural subgenera : beside the boa figures the Scytale coronata, the Eryx, and Herpeton ; with the Colubri are confounded the Pythons, the Homalopsis,* the Xenopeltis, the Heterodon, the Tree-snakes, and the Oligodon. The venomous snakes are subdivided into the venomous properly so called, in which the fangs are isolated, and the venomous in which the dangerous weapons are followed by several solid teeth. The first of these two families is established for the reception of the Crotalus, the Trigonocephalus, the Vipera, the Naja, the Elaps, the Platurus, the Langaha, and several other new subgenera, but of too little importance to be here enumerated ; the second comprehends the Bungarus, the Sea-snakes, and the Acrochordus, under the name of Chersydrus ; the Cæcilia, as a third tribe, terminates the order of Ophidians. In passing this classification in review, we shall limit ourselves to remark, that Cuvier, attaching too much importance to the dentary system of serpents, and to the form of the under scuta, departs in several respects from the natural system. At least, it seems to me, that a union such as that of Hydrophis, of Bungarus, and Acrochordus, cannot be suitable to any method, natural or

* Genus Cerberus of M. Cuvier.

artificial. How is it that the Elaps and Naja, Ophidians whose jaws are furnished, besides the fangs, with solid teeth, have been arranged among the venomous serpents with isolated fangs! The Langaha is also in that division, although neither its form nor its structure offer the least analogy to venomous serpents. We see in the same system the Boa, the Python, and the Acrochordus, figure in four different families. The Scytale coronatus and the Eryx, form a part of the genus Boa; the Uropeltis (the true Typhlops) is found in the series, whilst the Xenopeltis has been excluded from it to take its place among the Colubri. These remarks will suffice to shew to how many errors the principle of classing serpents according to the form of the subcaudal plates, has given rise.

Besides the works of LACEPEDE, of LATREILLE, and of DAUDIN, we possess a complete enumeration of the known species of serpents, published in 1820 by MERREM.* The author, in adopting the great divisions of Ophidians into venomous and innocent, has arranged most of the latter in the genus Coluber, a denomination which he has very inappropriately changed to *Natrix;* and he terminates a long series of these animals by the genus Dryinus. At the head of the harmless serpents are found,—1st, The Acrochordus; 2d, The Rhinopirus, a name substituted for Herpeton; 3d, The Tortrix, a medley of the genera Tortrix, Eryx, Typhlops, Acontias, &c.; 4th, The Eryx; 5th and 6th, The Boa and the Python, genera which include a great many heterogeneous species; 7th, The Scytale, a confused melange, which is followed by, 8th, The Hurriah, a reunion as absurd as the name which designates them. MERREM has taken care, in his distribution of venomous serpents, to adopt almost all the generic names invented by his predecessors; he has multiplied their number by the addition of several new designations; his Sepedon is established in favour of the Naja Hæmachates; his Pelias includes a Viper and a Trigonocephalus; his Echis reposes on the Vipers. But this learned man, without the least necessity, has introduced numerous changes in the nomenclature; such are the introduction of

* *Tentamen Systematis Amphibiorum.* Marburgi, 1820.

the generic names Acanthophis, Echidna, Cophias, and Natrix, substituted for the established denominations, Ophryas, Vipera, Trigonocephalus, and Coluber.

It is almost to the same epoch we must refer the extensive researches of the late H. Boie on Reptiles. This zealous and indefatigable naturalist, in arranging the materials of the collection of serpents in the Museum of the Low Countries, has proposed numerous generic sections, in a great measure established at the expense of those already known. This great work, in which Boie had collected his researches, having been unpublished to the present day, it has happened that extracts have been communicated to many herpetologists, who have hastened to adopt the views of the late Boie, before the original researches could be laid before the public. It was only in 1827 that M. Fr. Boie of Keil published a sketch of the researches of his brother, enriched with his own remarks. The following are the names of the new genera of Ophidians contained in the work of the late M. Boie:—Xenopeltis (Reinwardt); Brachyorrhos (Kuhl); Lycodon (Boie); Oligodon (Boie); Amblycephalus (Kuhl); Elapodis (Boie); Homalopsis (Kuhl); Xenodon (Boie); Tropidonotus (Kuhl); Herpetodryas (Boie); Dendrophis (Boie); Psammophis (Boie); and Chrysopelea (Boie). The specific description of my work being in some measure founded on the labours of Boie, it may be seen on consulting the memoir I have just mentioned, in what my views differ from those of my predecessor.*

About the same period appeared several iconographic works and observations on the Fauna of Brazil, which have greatly contributed to clear up one of the most confused departments of the science. The labours of the Prince of Neuwied deserve to be first mentioned: this august traveller is almost the only person who has made observations on the habits of exotic serpents, and his book must be included among the most precious of those that have ever appeared on Herpetology: his exact, though minute description, cannot fail to be extremely useful; the

* Isis, xx., p. 508.

plates which illustrate them are executed with care, and represent the objects with exactness. We regret not to be able to give the same praise to those published by Wagler from the specimens collected in the travels of M. Spix. We find introduced into this book, under new names, the most common species; the same species is sometimes figured under several different denominations, and even disposed in different genera; the species collected in Spain are there described as natives of Brazil; the number of genera has been most unnecessarily augmented, and new generic appellations are arbitrarily substituted for the old. The author, in loading his descriptions with idle details, has rendered them diffuse: in a word, the defects which abound are not at all compatible with the ostentation displayed in this work, and in some similar publications.

The design of the works of M. Fitzinger professing to be an arrangement of Reptiles according to their natural affinities, this herpetologist has reunited the Ophidians to the Saurians, which are divided into many families; the denominations which he has used to designate the numerous generic groups he has created, are in a great measure borrowed from the barbarous momenclature of Seba; an enumeration of the Ophidians that form a part of the Museum of Vienna is annexed to his little work, as an illustration of his views. Mine differing in many respects from his, I shall here state some facts scattered throughout his book, to serve as points of comparison.

The genus Duberria of M. Fitzinger comprehends species which make part of my genera Calamaria, Coluber, Xenodon, Coronella, Naja, and Lycodon. We see arranged among his Colubers, species of Coronella, Psammophis, Lycodon, Xenodon, Herpetodryas, Dipsas, Tropidonotus, and true Colubers; in the family of the Colubroides are included the Acrochordus, Hydrophis, Herpeton, Xenopeltis, and all the other harmless serpents, with the exception of the Tortrix and the Boa; but of the two succeeding families each contains sea-serpents, which figure beside the Viper, Elaps, or Naja, genera too widely sepa-

rated from each other, to be included in two well characterized families.

The nature of the system recently published by the late M. Wagler defies all analysis; always led astray by the sallies of an ardent imagination, often guided by principles which should ever be strangers to science, anticipating the spirit of the age, this laborious zoologist has created a system in which the venomous and harmless serpents are huddled together pell-mell,—the sea-snakes with the terrestrial, the fresh-water species with tree-serpents—a system supported by diffuse but specious reasoning, often forced, and more lively than just; a system with a crowd of new-invented divisions, the number of which alone makes the most tenacious memory tremble. The same writer has been useful by the publication of Herpetological Plates.

It remains for me to mention M. Lenz, who has studied even in the minutest details the manners and habits of Indigenous Serpents. I have often had recourse to the scientific observations of this naturalist, which are contained in a General Natural History of Serpents, written in a popular and often diffuse style, but which shews that the author is more familiar with the literature of this part of science than with the objects themselves.

I omit many other attempts by anatomists or by philosophers to establish natural *systems* of ophiology: suffice it to quote, as an example of Essays of this sort, the memoir of M. Rietgen, inserted in the 14th Volume, Second Part, p. 245, of *Transactions of the Leopoldine Academy.* Many other Savans, in short, have contributed to the progress of ophiology, by publishing isolated *observations.* Travellers have enriched their journals by numerous scattered remarks, relating to the manners of serpents, in which they have described *unedited* species: to this number belong Pallas, Hasselquist, Forskäl, Bruce, Bartram, Bosc, Palisot de Beauvais, Paterson, Russel, Madler Merian, Maregrav, Mikan, Raddi, the Prince of Neuwied, Spix, Say, Davy, White, Lesson, Wiegmann, and several others which we have mentioned in speaking of their works. Other naturalists have applied themselves

to describe or to enumerate the ophidians of a particular country, or at least to collect materials for the faunæ of different regions of the globe. Besides the grand works already mentioned on the East Indies, Brazil, North America, and Egypt, the Monograph of the Serpents of the environs of Rome by METAXA is particularly distinguished; those of Hungary, published by FRIVALDSZKY; of Switzerland, by WYDER; of Lithuania, by DRUMPELMANN; of Italy, by the PRINCE of MUSIGNANO; of Germany by STURM; of Holland, by VAN LIER; and of North America, by HARLAN; many philosophers, as WOLF, MEISSNER, WAGNER, BOIE, VOSMAER, FLEISCHMAN, BODDAERT, GRONOVIUS, BELL, GRAY, LICHTENSTEIN, BRANDT, and BATZEBURG, and some others, have published detached observations on the nature of snakes, which have extended the boundaries of our knowledge, by the descriptions they have given of new species.

It is also proper to notice the labours by which anatomists and physiologists have, especially in later times, illustrated ophiology. The fine and numerous experiments on the poison of the Viper, by REDI, CHARAS, and especially by FONTANA, and the description which those philosophers have given of the poisonous apparatus, are worthy of the attention of the naturalists of every period. Celebrated anatomists such as CUVIER, and MECKEL, have, in their Manuals on Zootomy, demonstrated the organization of serpents; others, such as CLOQUET, DUVERNOY, MAYER, TIEDEMANN, SCHLEMM, WINDISCHMANN, J. MÜLLER, &c., have furnished interesting dissertations on the various organs of those animals; M. HERHOLDT has made researches on the physiology of our indigenous species. A crowd of other observers, in fine, whose names I shall quote in their proper place, have contributed to extend our knowledge of the natural history of serpents.

SYNOPTICAL VIEW OF OPHIDIANS.

I come now to my proper subject. I have already mentioned in the Preface, the motives which induced me to give my work the title under which it has appeared. The general part of my book has no need of commentary; consequently I have only now in the following pages to give a synopsis of the descriptive or special part.*

I have retained the old division of serpents into INNOCUOUS and VENOMOUS. The constant character of these last is, being provided with a gland of a cellular structure, secreting a fluid which, introduced into the animal frame, there produces deleterious effects. The maxillary teeth, much longer than the rest, are hollow internally, and provided with two orifices, one for the entrance, and the other for the exit of the venom; they are called Fangs, and are the weapons by means of which those serpents inflict wounds, and at the same time introduce into the wound the destructive fluid. It is very difficult, if not impossible, to assign to venomous serpents distinctive external characters. Several of them, as sea-snakes, are distinguished by their flattened tails; the venomous snakes properly so called, have something so peculiar in their general form and their physiognomy, that it requires but a small experience to recognise them at the first glance: but it is not so with that family of venomous serpents to which I have given the name of Colubriform: the greatest number of these reptiles so much resemble innocuous snakes, that naturalists even have confounded the two races. A muzzle generally thick and rounded, a short, thick, and conical tail: these are the principal external characters, little prominent it is true, which can be assigned to the colubriform venomous serpents. The habits of venomous serpents offer several other marks to distinguish them from the harmless species; and

* [This special or descriptive part is not now translated. It forms a volume about double the size of that now submitted to the English reader, and constitutes the clearest and best digested general description of serpents which has fallen under the notice of the Translator.]

we may particularly observe, that the former exclusively inhabit the sea or the land, that they do not climb trees,* and that they never frequent fresh water, with the exception, perhaps, of some species of Naja.

INNOCUOUS SERPENTS.

In distributing the *Serpents not venomous* into families, I have chiefly kept in view their mode of living. Those sections which have little importance as regards organization, have only been adopted for the purpose of facilitating a review of species.

The *First Family* comprehends the *Burrowing Snakes*, the only genus of which is the

TORTRIX.

We may assign to them as distinctive marks—a cylindric body, with almost the whole trunk of the same dimensions; a short and conical tail; a small obtuse head, of the same diameter as the trunk, and covered with plates imperfectly developed; small eyes; narrow nostrils; a mouth but little cleft; the tympanites very massive; the teeth short and conical; in fine, a certain resemblance to the Amphisbæna and Typhlops. The Tortrices often exhibit hooks at the anus; they inhabit hot countries in both worlds, they never leave the ground in which they dig burrows. We only know five species. I place at the head of the genus—

1. TORTRIX SCYTALE of Surinam, remarkable by its slender trunk, filiform and ringed with black and red; the eyes are placed in the centre of the ocular plate; the short tail is very obtuse; it sometimes grows to the length of 3 feet; scuta 225 + 12. The second species,†

2. TORTRIX RUFA comes from Java and Celebes, where

* The Trigonocephalus viridis is an exception to this rule, in so far as it has the habit of attaching itself by its prehensile tail to branches of shrubs, to watch for its prey.

† [M. Schlegel always indicates the number of abdominal and subcaudal scuta by this symbol; the first number being the abdominal, the latter the subcaudal, with the sign + *(plus)* between the numbers.—*Tr.*]

it forms a variety produced by climate, very distinguishable by its deep tints; more massive than the preceding; it has the trunk of a shining blackish-brown, ornamented with transverse white bands, which become of a beautiful red on the head and tail; it has a very short and pointed tail; dimensions $2\frac{1}{2}$ feet; scuta 195 + 6.

3. Tortrix maculata.—The isle of Ceylon produces this species, in many respects like the last; but what distinguishes them, besides the slight difference in shape, is the colour of the latter, being a yellowish-brown, relieved by a reticulated pattern in black; it does not exceed a foot in total length, and has about 190 + 6 scuta.

4. Tortrix Eryx is the fourth species, an inhabitant of the sandy districts which extend from Egypt to Hindustan: it has the short tail massive and obtuse; all the parts are covered by very small scales; the muzzle is obliquely truncated at the point; the eye has a pupil perpendicularly elongated; it attains the length of $2\frac{1}{2}$ feet, and has 195 + 20 scuta. This species probably forms in India several constant varieties, of which we have not yet sufficiently studied the distinctive characters.

5. Tortrix Pseud-Eryx is very near akin to the Eryx, and is a native of New Holland; it is distinguished from the former by a tail more long and prehensile, by a body more thick and compressed, by a greater development of abdominal and frontal plates, and by the number of the scuta which equal 200 + 60.

6. Tortrix Xenopeltis, the sixth, presents a less cylindric trunk than the other species; its tail is longer and conical; it wants the hooks at the anus, and the plates of the head approach the normal form; a beautiful shining blue-black is reflected from the whole surface of the polished epidermis; the head is white in the young animal; the size 2 feet; scuta 175 + 28; a native of Java, Sumatra, and Celebes.

7. Tortrix Boa is a rare species, found in New Ireland; it has a general resemblance to the form of the Xenopeltis; but its lips are hollowed by fossettes, as in the Boa, and the body is surrounded by alternate rings of black and white; it has 250 + 44 scuta.

Writers on Ophiology have classed in the genus TORTRIX several reptiles which must be rejected on a rigorous examination of the descriptions on which the species have been founded. Among this number must be included the TORTRIX MELANOSTICTA of MERREM, Tent., p. 82, established after RUSSEL, Sup. i., No. 42, which seems to belong to the genus Anguis; the TORTRIX RETICULATA, ib., which has for its type SCHEUCHZER, *Bibl. Sacra*, pl. 747, f. 4, which is a representation of the TYPHLOPS LUMBRICALIS; the TORTRIX RUSSELII, which is only known from a description by PALLAS, under the designation of ANGUIS MILIARIS; lastly, we must reject the TORTRIX BRACHYURA and T. ANNULATA of MERREM, p. 82 and 83, which repose on too slight a foundation to merit a place in systems.—SCHLEGEL, part ii.

The *Second Family* of Innocuous Ophidians is *The Vermiform;* and contains but a single genus,

CALAMARIA.

It consists of small terrestrial snakes, with a body almost constantly cylindrical, like a pack-thread, and terminated by a tail usually conical and short. The head is generally on the same line as the body, and covered with plates, with those of the muzzle usually less numerous than in the following genera. The Calamars present often iridescent tints, and the red predominates sometimes in the under parts; the scuta are rarely numerous. They inhabit hot climates or near the tropics, and are found in both worlds.

1. CALAMARIA LUMBRICOIDEA is one of the most remarkable species, and is very rare in Java and Celebes. Its body, several feet in length, is, throughout, of the thickness of a swan's quill; the tail is short, conical, and exhibits from 16 to 23 divided scuta. There are only two frontal plates which at the same time occupy the place of the frenals; there are but two oculars. Above of a blackish-blue, below a bluish tint with blackish spots, and a yellow hue or ray along the flanks. Scales smooth, square, and disposed in 13 rows. Abdominal scuta 190 to 217. Another species,

2. Calamaria Linnæi, from the island of Java, resembles the preceding in form, and in the disposition of the plates of the head and the scales of the trunk; but its body is less thread-like and scarcely exceeds a foot in length. The colours are not less subject to variation than the length of the tail. The lower parts are often of a vermilion-red, ornamented with large, square, black spots. Plates or scuta 130 + 90 to 160 + 20.

3. Calamaria Orbignyi of Chile appears to represent in the New World the Cal. Lumbricoidea, of which it has the shape and appearance; but its neck has 15 rows of scales, and all its parts are smaller. Above it is of a burning brick-red, the lower parts of a pearly lustre. The top of the head, a spot on the nape, and a band on the tail, are deep black. S. 264 + 30.

4. Calamaria amœna is found in North America, and corresponds in size and form to Cal. Linnæi of the East Indies; its mould, however, is more slender, and the abdominal scuta, as well as the nasal plates, are a little broader. Above a shining brown, below red. The mean number of scuta 120 + 30.

The following species recede more or less from the preceding, which form the type of the genus:

5. Calamaria Diadema, the only one known in New Holland, presents exactly the form of the preceding; but we only find on it two pairs of frontal plates. It is of a pale yellowish-brown, clearer below, with transverse spots of white on the occiput. S. 170 + 45. 13 rows of scales.

6. Calamaria Brachyorrhos is found in the isles of Java and Amboina, and has the same number of plates on the head as the last; but it has a stouter make than the typical species, a trunk more thick and tapering towards each end, a head very conical. Of a dull uniform brown, passing into yellowish below; 17 rows of scales. S. 138 + 13 to 180 + 38.

7. Calamaria Badia of Cayenne, with a less vigorous mould and smaller size. It has the general aspect of the last, but its tail is more slender, its head more obtuse, its eyes larger, and has a small frenal plate on each side. This species, clouded with brown and ochre-yellow, presents a

very variable disposition of the colours in different individuals. Rows of scales, 17. S. 150 + 20 to 184 + 44.

8. Calamaria arctiventris comes from the Cape of Good Hope, and resembles in form a small Coluber; the head and the plates with which it is covered are more developed than usual; the body is very thick for the size of the animal, and the tail is pointed. It is distinguished from the other species by its belly being strongly angular, and by its colours; above a chestnut-brown, below yellow; the flanks greyish-blue, dotted with close-set black points. Rows of scales, 15. S. 130 + 30.

9. Calamaria melanocephala is found in both Americas, and approaches in form to an Elaps. Its body is of equal thickness, the tail more slender than in the preceding snakes; the head truncated at the snout, and hardly distinguished from the neck. The system of colours presents distinctive marks; below yellowish, above of a pale brown, with three longitudinal black rays; head adorned with black spots. Rows of scales, 15. S. 155 + 60.

10. Calamaria punctata is a native of the southern parts of North America; resembles the last, but differs by a less cylindric body, a head more distinct from the neck, smaller scales, and a different system of colours. Above is of a deep brown-grey, with a white collar; below of a yellowish-white. A series of black points extend along the middle line of the abdomen. Rows of scales, 15. S. 170 + 50.

11. Calamaria Oligodon, the eleventh species of the genus is remarkable, as it is the sole example of a serpent without palatal teeth; but otherwise, in mould and appearance, analogous to the Calamars. Its head is rather thick, obtuse, and inflated at the cheeks. This species is also distinguishable by its colours: the inferior parts, as in the Cal. Linnæi, are of vermilion-red, with square spots; the upper parts of a deep bronze, with large white spots distributed at regular distances on the back; on the head are several black bands. This Calamar is rare in Java, and forms in Sumatra, Ceylon, and the Philippines, beautiful varieties, from the effect of climate, distinguished by the distribution of their tints; the abdominal spots are red,

and in the last two varieties the spots are disposed in three rows. The Sumatran variety has large, thick-set, oval, dorsal spots. Rows of scales, 17. S. 145 + 35.

12. Calamaria Scytale from the Philippines and Ceylon, characterized by the existence of a pairless anterior frontal plate, and also by a tail provided with undivided scuta; approaches in form to Cal. Badia. Above brownish, passing below to tarnished ochre-yellow; three dark spots on the occiput; as many rays, composed of dark points, along the back and flanks. R. of scales, 17. S. 140 + 30.

The southern parts of North America produce,

13. Calamaria Striatula, which is also found in the Isle of Martinique. It is recognised by its conical head, covered with plates like those of a Coluber, except that the frenals are wanting, by its large eyes, by a very pointed tail, and by lanceolate scales, always surmounted by a strong keel. Above of a pale greyish-brown; below yellowish. R. of scales, 15 to 17. S. 120 + 35.

14. Calamaria Elapsoides of Java has lanceolate carinated scales, like the preceding; but it attains a larger size. The eyes are smaller, whilst the nostrils are very open; the head differs in shape, and the tail is more slender; the colours, which are most brilliant, distinguish it from all the other species. Above, carmine red; below, pale azure blue. R. of scales, 15. S. 150 + 70.

15. Calamaria Blumii, an anomalous species of South America, approaches both the Tortrix and certain Homalopsis. It has a more vigorous form than any other species, a cylindric trunk, a conical and strong tail. Its head is depressed, obtuse, the eyes are very small, and a very long tooth is perceived at the posterior part of the maxillary bone; six labial plates, two oculars, and two frontals; elongated occipitals. Above brown, marbled with dark points, and relieved with three obsolete rays; lower parts and its half-collar yellowish. R. of scales, 15. S. 180 + 35.

16. Calamaria coronata. This Calamar, discovered on the coast of Guinea, has the plates of the head like those of the genus Coronella, but has the small size of a Calamar. Its tail is more slender than usual; the trunk slightly

compressed and surrounded with 19 rows of scales: this species is distinguished by four transverse black bands which adorn the head. This species is, above, brown; below of a yellowish-grey. S. 185 + 70.

17. CALAMARIA ATROCINCTA. I have arranged in this genus the present anomalous species, a native of Chile, which approaches in form to certain Lycodons, but by the distribution of its colours it recalls the Coronella venustissima and the Elaps corallina. It has an angular abdomen, a body banded with red and black. Rows of scales, 15. S. 196 + 57.

18. CALAMARIA CORONELLA. We come at last to this species, which might at first be mistaken for a small, smooth Coronella; but its head is very thick, the frenal plates are wanting, the occipitals are broad, its form is very massive; it has but 15 rows of scales. The general colour is a yellowish-grey, passing to brown, and the upper parts are marked by numerous dark transverse bands, but not very distinct.

In *the Third Family* of Innocuous Ophidians we have united all the *Terrestrial Serpents* which have not been included in the two preceding families. With the exception of the Heterodons, they present but few anomalies in their organization, and are modelled, so to speak, on the type of the genus Coluber. The most of them have the head covered by 9 plates, and the scales of middle size and smooth.

The first genus is

CORONELLA.

It comprehends species which in their organization resemble the true Colubers; but they have a less size, a more compressed trunk, generally pentagonal, and covered with scales, for the most part smooth, and distributed in seventeen to nineteen ranges; a tail conical and rather long. The genus Coronella inhabits the warm and temperate climates of both worlds; they have not hitherto been observed in New Holland. They inhabit plains, and prefer humid places.

1. Coronella venustissima. South America produces this beautiful species, distinguishable by its slender form and its colours; a fine vermilion-red is the ground colour, and all the body is surrounded with fifteen pairs of black rings bordered with white. The scales with black points are disposed in 15 rows. The abdominal plates are 200; those of the tail vary from 45 to 100.

At Surinam, this snake is replaced by one very analogous; but which has a more slender form, and consequently a smaller number of abdominal plates, which are only about 180: we may confer on this serpent the name of Coronella venusta, if we would consider it as a distinct species: it is very common, and known as Coluber agilis.

2. Coronella coccinea is another closely allied species, inhabiting North America, but is of smaller size than the last; the eyes are smaller; the vertical plate is massive, and the superciliary small. R. of scales, 17. S. 170 + 35.

3. Coronella Merremmii is common in Brazil, and is remarkable for the vast number of varieties it affords accidentally, or from age. Its head is very broad, and covered on the summit by small plates of an elongated form. The large rhomboidal scales are disposed in from 17 to 19 rows. The under parts are usually yellow; the upper in adults is of a greyish-green, dependent on a round spot in the centre of each scale. The young have a system of colouring, like that of the preceding species, but the black rings become effaced with age, and the red tint becomes brown. S. 139 + 50, or 183 + 68.

4. Coronella Reginæ occurs in Surinam, Brazil, and even in Guadaloupe. In form it resembles the preceding, but the colours are different; above greyish-blue, below yellow, with square spots of black; small black spots ornament the sides, and there are white spots near the angle of the mouth, and on the neck. R. of scales, 17. S. 140 + 70.

5. Coronella Cobella is common in Surinam, and appears also to be found in North America. The frame is

more clumsy than in the two preceding species. Above varied with brown of two shades; below deep yellow, marked with black square spots; scales bordered with black, or with white. R. of scales, 17. S. 160 + 50.

6. Coronella Baliodeira, the only species of the genus Coronella known in Malayan Asia, was discovered in Java and Sumatra. Of a size less robust than most of the other species, it approaches in its form the Calamars; but its eyes are very large, and its head high. Above of a vivid brown, relieved by white ocellated spots; below yellowish. S. 128 + 68. R. of scales, 13.

Europe only produces a single species,

7. Coronella Lævis, which prefers dry situations to low and swampy places; it is of a very shining brown bay, ornamented with chequered, irregular patches of black, which form a very characteristic pattern on the head: below it is yellowish, marked with square black spots. S. 175 + 55; R. of scales, 21. The young of this species are hatched in the belly of their mother. The southern countries of Europe produce a *climatal* variety, distinguished by its more vivid tints.

8. Coronella Chilensis (the Tachymenes of Wiegmann) resembles that of Europe, but its head is more conical, and is covered by smaller plates; its tail is shorter, and the upper parts present four deep-coloured rays, extending from the occiput, whilst we find below several rows of blackish marks, often well defined. S. 158 + 46. R. S. 19.

The four following species are found at the Cape, and differ from the preceding species in several respects.

9. Coronella rhombeata recalls, by its general organization, the European species, although it approaches by its elongated form, the Psammophis. Its head is small, conical, and terminated by a straight rostral, which is prolonged on the top of the muzzle; the other plates of this part are narrow, and the occipitals short. A grooved posterior tooth is observed in the jaws. The yellowish-brown of the upper parts is ornamented with three or four rows of ocellated spots of a lozenge form. S. 155 + 72. R. S. 17.

10. Coronella rufescens is another Cape species, very different from the last, and is recognised by its uniform hue of a pale brownish-purple, and by a large, dark, nuchal mark. Below it is yellow: it has the pupil of the eye perpendicularly elongated; and has a posterior grooved tooth in the jaws. S. 160 + 45. R. S. 19.

11. Coronella rufula approaches to the Lycodons by its form, and its front teeth longer than the rest; but the pupil of the eye is obicular, and the plates on the head are more elongated. It is of an uniform brown verging on red, and has a tail very thick, and much longer than usual. S. 157 + 110. R. S. 19.

12. Coronella aurora is one of the most beautiful and rarest species. It is very distinguishable by its tints; yellow below, yellowish brown above; the back is marked by a wide ray of an orange-yellow, which passes along the animal through its whole length. It has an aspect more heavy than ordinary; its very thick tail only begins to diminish towards the point. The muzzle is obtuse; the temporal plates take the form of scales, and the abdominal scuta are very compact. S. 180 + 46. R. S. 19.

We come, finally, to two Asiatic species, a little anomalous; the first is,—

13. Coronella octolineata, which has a thin body, a narrow abdomen, a little angular at the sides. There exist only six labial plates, and a frenal at each side; the rostral is large, and extends between the frontals. We find, on a brownish-yellow ground, four longitudinal, dark, dorsal rays, of which the lateral are sometimes double: these rays are prolonged on the head, where they form an acute angle. S. 178 + 52. R. S. 17.

14. Coronella Russelii, a very handsome species, inhabiting Bengal. It approaches certain Xenodons, of which it has the dentary system, especially of the Xenodon purpurascens, which it also resembles in the distribution of its colours. The muzzle is obliquely truncated downwards: it has seventeen rows of lanceolate scales. Above earth-brown, relieved by a series of large patches, chequered, and little constant in shape. There are on the head several angular markings. S. 155 + 54.

The second genus of Terrestrial Serpents is the

XENODON.

These may be considered as Coronellæ, mostly of a large size, with a lumpish form, a large head, a short or truncated muzzle, a thick trunk, and flattened belly. We perceive in their upper jaw a solid posterior tooth, very long and compressed. Their scales are smooth, and disposed in very oblique rows, especially on the neck, which is very expansible; and has the ribs less curved than ordinary, in which the animals approach the Najas. The plates on the head are squat and broad. This genus is not rich in species, and the Xenodon belongs to the class of rare serpents which inhabit, in small numbers, the hot and temperate climates of both worlds; not a single species is known in Africa, nor in New Holland. Some prefer a humid situation; but others, that delight in dry places, depart from the typical species to approach the following genus, the Heterodon.

1. XENODON SEVERUS of Surinam and Brazil unites especially the characters which we have assigned to these animals in general. It has all its parts very heavy and thick, and the plates on its head short and broad. The lung, enveloping the trachea, occupies the space between the heart and the throat. The ground is of a pale brownish-yellow, ornamented above by a dozen of dark ocellated spots, extremely broad. We perceive on the head several transverse bands, and angular marks on the occiput. The colours in adults are so effaced, that their original disposition can with difficulty be traced. I have seen individuals of an uniform red, while others were of a brown-green; S. 140 + 36. R. S. 21. It is a serpent of large size, which appears to feed exclusively on the great frog of South America, and which swims with much dexterity.

2. XENODON RHABDOCEPHALUS of Brazil is so near the preceding, that they seem only to form one species, distinguishable by a form a little more elongated, from which results a number of scuta, varying from S. 140 + 44

to 180 + 60. R. S. 19. The lung extends behind the heart into the abdominal cavity. The colours of this Xenodon are very subject to variation: they are found brown, red, and sometimes of a very uniform olive-grey.

3. Xenodon inornatus inhabits Java, where it is very rare. It is of an uniform olive-brown, and has very nearly the form of the Xenodon Severus, although it is very inferior in size; S. 120 + 38. R. S. 19. The young have the upper parts relieved by very indistinct transverse bands, and there are several bands on the occiput, which unite into an angle.

4. Xenodon purpurascens, an inhabitant of Java, as rare as the preceding, is distinguished from all the rest by a system of colouring extremely beautiful. The form recalls that of Coronella lævis; but our Xenodon is more robust, and of a habit more vigorous. It has the rostral plate very large, vaulted, and salient; the muzzle is a little truncated at the extremity, and the abdomen is slightly angular. The general colour is a brick-red, covered with dark marblings; above it has eighteen broad bands or spots of a reddish-white, punctured with black; S. 175 + 45. R. S. 19.

There exists in Brazil a third species, the

5. Xenodon Schottis, which presents a more attenuated form than the preceding, and its narrow head is terminated by a rostral plate, slightly salient. Above olive-brown; below yellowish. S. 178 + 46. R. S. 19.

6. Xenodon Michahellis is the only species of Xenodon known in Europe; it inhabits Spain and the south of France. It is distinguished by its short and conical head, terminated by a prominent rostral plate; by scales disposed in twenty-seven rows, and by the large number of its scuta (216 + 60), by its short and conical tail, and by its olive-brown colour, relieved by two dorsal rays of a dark hue; several other rays descending on the sides of the head. The system of colouring in the young differs entirely from that of the adults, inasmuch as the tints are very clear, and relieved by large spots.

7. Xenodon Typhlos of Guyana unites to the habit of a Coronella the form of the Xen. Severus in every thing,

except in the head and the plates which cover it being less, and in the abdomen being a little angular. Beneath, yellow, the upper parts of a smoke-grey, sometimes approaching to a greenish, sometimes to a bluish hue. S. 140 + 50. R. S. 19.

I have arranged, as an appendix to the genus Xenodon, an Ophidian of uncertain origin, but which probably comes from Brazil: it is our

8. XENODON BICINCTUS. It approaches the Coronella, and has a pretty robust form. The eye is bordered by a circle of 6 plates, and the rostral is very depressed. The body is surrounded by broad bands or double rings of brown, disposed on a yellowish ground, and forming below square spots. S. 192 + 89.

HETERODON.

The snakes of this genus are Coronellæ, or rather Xenodons, with the head prolonged into a conical muzzle, generally terminated by a hard salient plate, truncated at the extremity. They have only been observed in the New World, where they inhabit sandy places. The other plates of the head are less than ordinarily developed. The predominant colour is red, relieved by spots or rays of a dark colour. These animals do not attain a large size, and they are among the rarest of Ophidians.

1. HETERODON PLATYRHINUS is the best known, and is distinguishable by its massive and vigorous form, and especially by its turned-up rostral plate, projecting in the form of a crescent; it has several frontal scales, and the labial plates are very high. Scales lanceolate, carinated, and disposed in 21 rows. S. 124 + 38. Body covered with wide, dark spots, on a reddish-grey ground. Country, North America. Brazil produces a climatal variety of the same species.

2. HETERODON RHINOSTOMA, a native of Brazil, resembles the last in the form of its rostral plate; but this part is smaller in this species; the plates on the head affect a more regular figure; its scales are smooth, and dis-

posed in 15 rows, and its body is more elongated. S. 190 + 64. Extremely rare.

3. HETERODON COCCINEUS, the third and last species of this genus, is of smaller size, has a pointed head, a projecting but not turned-up snout, and the body is of a burning-yellow, marked by broad spots of a purplish-red. R. S. 19. S. 170 + 50. This species comes from Mexico and the southern provinces of the United States.

LYCODON.

The Lycodons compose the fourth genus of non-venomous Terrestrial Serpents. They are Ophidians of a middle size, with a body usually slender, and sometimes thread-like. Their characteristic is the possession of anterior maxillary teeth longer than the rest. Their eyes are small, the pupil vertically elongated. The vertical plate, and the anterior frontals, are small and aggregated, but the occipitals are considerably elongated; there is only a single frenal. The scales are lozenge-shaped, and usually smooth; the abdomen is angular in most of the species, and the tail is often defended by simple scuta. The dominant tint is an earth-brown; the scales are sometimes bordered with white, and the neck ornamented with a bright collar; other species have the body annulated with black, white, or red. The Lycodons inhabit the equatorial regions of both worlds, but they are unknown in New Holland.

1. LYCODON HEBE, the first species, has a depressed head, and obtuse muzzle. The posterior frontal plates and the occipitals are very long. Rows of scales, 17. S. 196 + 68. Colour, a brown-grey, more or less dark above, ornamented with bright and chequered spots. This last tint borders the scales, and forms a broad collar. The distribution of the colours is subject to accidental varieties; others arise from climate; the specimens from Bengal are very bright; those from Java and Timor are deeper, and of a less robust make.

2. LYCODON CARINATUS, a native of Ceylon, where it is very rare. It has simple scuta under the tail, and the carinated scales are disposed in 17 rows. Colour, coffee-

brown, more clear below, where it is marked with whitish spots. S. 188 + 60.

3. Lycodon Jara, from India, is a small black species, with a very wide white collar; the scales are marked with two fine streaks or rays. Below, whitish. S. 175 + 56.

4. Lycodon geometricus, a large and handsome species, of a thick form; the native place unknown; above, reddish brown; below, two streaks or rays along the flanks, and another round the summit of the head, of a yellowish hue. 21 rows of smooth scales. S. 220 + 51.

5. Lycodon Horstokii. Observed at the Cape and on the Gold Coast; of small size; of an olive-brown colour, very shining, with the tips of the scales marked with a pearly spot, a colour which sometimes forms narrow transverse bands; below, yellowish. 17 rows of scales. S. 190 + 43.

6. Lycodon unicolor. It forms, with the preceding, the only two species discovered in Africa. It inhabits the coast of Guinea, and is known by its uniform tint of a fulginous brown, paler below; it is distinguished from the last by the number of scales and scuta, which amount to 27 rows of scales, and S. 220 + 60.

7. Lycodon formosus, a very beautiful species, of a slender shape, a narrow head, a frenal plate very long, extending to the eye; the body is marked by very broad alternate rings of a beautiful vermilion and a shining black; the scales have black borders; 17 to 19 rows of scales; abdominal scuta vary from 168 to 220; subcaudal divided plates 66; inhabits Brazil.

8. Lycodon Clelia, is very remarkable by the variety it presents; the configuration of the head varying with the individual, and the tail having sometimes simple, at other times divided scuta; colour, earth-brown, sometimes pale, at other times dark; nape ornamented with a white collar; tips of scales brown; anterior teeth hardly longer than the rest; 15 to 19 rows of scales. S. varying from 148 + 65 to 218 + 101. Country, Brazil and Surinam.

9. Lycodon subcinctus. Muzzle extremely broad and obtuse; frenal plate touching the eye, on account of the want of the anterior ocular; nostrils very open; colour, a

shining blackish-brown; the body surrounded with about twenty broad white bands; 17 rows of scales. S. 208 + 75. From Bengal and Java.

10. Lycodon modestus. Allied by its organization to the Lycodon Clelia. Head more than usually conical; scales with a smooth surface, nearly square, and disposed in 17 rows. S. 200 + 84. Colour above, deep brown, the lower parts and the collar yellowish. Inhabits the Isle of Amboina, and also New Guinea, where it acquires a very large size, and has then very pale tints.

11. Lycodon Nympha. Form slender; head thick, and muzzle obtuse; eyes very large; 13 rows of smooth scales; abdomen narrow and angular. S. 220 + 85. Body brown, ornamented with pale bands or spots. Inhabits Bengal.

12. Lycodon audax, of Paraguay, approaches in shape to the Dipsas. Form compressed and elongated; tail very thin and slender; head thick behind; varied with brown and yellow, which form large chequered and irregular spots; plates of the head dark in the centre; 19 rows of scales. S. 200 + 110.

13. Lycodon Petolarius, has a shape like the preceding, but its head is a good deal narrower, and the body more slender. Teeth of equal size. S. 210 + 100. Body dark-brown, marked by numerous pale bands or rings, of which the disposition varies in different individuals. Inhabits Guyana, and is also found in Brazil.

The Coluber Dione of Pallas, a native of the Tartarian deserts, should probably be classed in the genus Lycodon. Never having examined this reptile, I leave to other naturalists the task of comparing it with the Asiatic species of the genus Lycodon. (Part II.)

The fifth genus of Terrestrial Serpents is the

COLUBER.

It comprehends all the terrestrial snakes of large size, which, holding a middle place among Ophidians, present nothing extraordinary in their organization. They ordinarily inhabit dry places, but some prefer the vicinity of

water. They equally delight in the warm and temperate climates of both worlds; but we only know a single species in Southern Africa, and they appear to be absolutely wanting in New Holland. The abdominal plates are necessarily very numerous. Their dorsal scales generally are slightly carinated. The majority have two posterior ocular plates. This genus is very rich in species.

1. Coluber Æsculapii, of central and southern Europe, has twenty-one rows of scales, of an olive-brown, with a pale-coloured collar; below it is yellowish. S. 228 + 79.

2. Coluber constrictor. Allied to the preceding in shape; but it has seventeen rows of scales, and a dark, uniform leaden colour. S. 183 + 94. Inhabits the United States of North America.

3. Coluber radiatus has a more light make than usual; above of a clear brown, relieved by four longitudinal dark rays; occiput marked by a transverse band; 19 rows of scales. S. 230 + 88. Country, Cochin-China, the Isles of Sumatra, and Java.

4. Coluber subradiatus replaces the last in the Isle of Timor, and is very like it; but its colours are deeper, and it wants the occipital band; the rays are interrupted, and its smaller scales are disposed in 23 rows. S. 235 + 90.

5. Coluber Blumenbachii presents a slight form, and a slender tail. The head is more distinct from the neck than in all the preceding species; the eye more voluminous; the abdomen is angular and furnished with very broad scuta; the back is slightly carinated, and the scales are arranged in 17 rows, more oblique than in the other species. S. 200 + 125. Above, olive-brown, verging on yellow, and adorned with dark narrow transverse bands, often very obsolete, irregular, or interlaced. Scales edged with black. This species is found in Malabar, Bengal, and Java.

6. Coluber Korros. Very analogous to the preceding, from which it differs by more narrow labial plates, and a shorter muzzle, a head less high, a trunk less compressed, and more elongated. S. 170 + 120. 15 Rows of scales. Inhabits Java and Sumatra.

7. Coluber Corais, the largest known of this genus, attains the length of 8 feet, and the thickness of a child's arm; comes from Surinam. Its form is very robust, its head powerful, its muzzle thick. Its physiognomy resembles the genus Naja; 17 rows of large scales; colour a reddish-brown, verging on a grey-purple; the young have transverse bands of a dark colour on the sides; below, yellowish-white. S. 202 + 75.

8. Coluber Melanurus has the head massive, and depressed, the muzzle obtuse; 19 rows of scales, strongly carinated; the labial plates are narrow; the trunk is compressed, and the abdomen very angular. S. 218 + 92. Remarkable for the changes of colour it undergoes with its age; the young are of a fine shining black, with a dorsal ray of citron-yellow; sides ornamented with a series of ocellated spots, with white centres; cheeks pure white. In the adult, the ground tint changes to brown, often passing to an ochre-yellow above, the colour that represents dorsal ray; the spots on the sides become indistinct, and only visible on the neck; the posterior parts pass to blackish. Inhabits Java. The Isle of Celebes produces a climatal variety, recognisable by an acute angular mark on the upper part of the neck. Another local variety, characterized by two black dorsal rays, and a similar ray on the sides of the neck, comes from Sumatra.

9. Coluber Pantherinus, a beautiful large species which inhabits marshy places in Brazil; form slender; head long and broad; above pale-brown, almost totally covered by two series of very large spots of an irregular shape, which sometimes form transverse bands; two dark rays on the neck, and two or three bands on the top of the head; 15 rows of very large and smooth scales. S. 175 + 90.

10. Coluber virgatus seems in Japan to replace the European C. quadriradiatus. Body compressed; abdomen angular; muzzle broad and obtuse; above brown, more or less clear, verging to green or olive, covered with large spots or transverse bands; the spots disappear with age, so that there only remain obsolete longitudinal rays; 23 rows of carinated scales. S. 240 + 110.

11. Coluber quadrivirgatus, also from Japan, and very near the preceding species, from which it is distinguished by a more conical and less blunt head, covered with plates more elongated, by a less vigorous body, surrounded with 19 rows of scales only, and ornamented with 4 dorsal rays, distinct in the adult; it is of a less strong make than the last, and has 200 + 87 scuta. The tints so vary, that some individuals are found wholly black.

12. Coluber Diadema. Scales carinated. S. 230 + 60; colour earth-brown; a black band between the eyes. From India.

13. Coluber miniatus, from the Isle of France. Habit thin; tail extremely slender; hence the great number of its scuta which amount to 199 + 145; 25 rows of smooth lozenge-formed scales; ochre-yellow on the fore parts; a tint which passes on the posterior parts into minium-red and to purple, varied with yellow marblings.

14. Coluber variabilis, has the body annulated and spotted with black and white, or yellow; it has the body very slim, the trunk very compressed, the abdomen angular, and the back carinated. The lozenge-formed scales are very large, carinated, and disposed in 15 rows. S. 204 + 100; teeth long and sharp; there is a small accessory lung. This species resembles certain tree-snakes of the genus Dipsas, particularly D. Dendrophila. Inhabits the woods of Surinam and Brazil.

15. Coluber plumbeus is very recognisable by its uniform system of colour; lead-coloured above, yellowish below. It is further distinguished by the presence of a long, grooved, posterior tooth, by its heavy and squat form, by a broad head, thick, and rounded; and by its physiognomy resembling that of certain Homalopsis. It has a body almost cylindrical; a short and conical tail; scales almost square, with smooth and shinning surfaces, disposed in 19 rows. S. 240 + 68. It is found the same in Brazil and in Surinam.

16. Coluber Pöecilostoma.—A beautiful species of large size, rare in Surinam, but comes also from Brazil; distinguished by its very thick head, massive and broad, and covered with very wide plates; by its lanceolate, cari-

nated scales, disposed in 21 rows; by a slender tail; and by tints of a yellow, verging sometimes to brown, sometimes to green. The head is of a brownish-red, and its posterior parts often dark coloured, while the abdomen is yellowish: the female has the lower part of the head reddish. The eye is large, and bordered posteriorly by three plates. Inhabits marshes in deep forests, and in manners approaches the Tropidonotus.

17. Coluber Canus, the only species of the genus known in southern Africa, in its organization resembles the Psammophis, or sand-serpents; head small and conical; muzzle terminated by a salient, vaulted plate; eyes rather large; scales small, truncated at the top, smooth, and disposed in 27 rows; tail short and thick. Its anatomy presents several curious particulars: the penis is double at each side, the cranium has the form of that of the Herpetodryas, the mastoid bones are extremely large, and the strong teeth become longer towards the extremity of the muzzle. Size large, even six feet. S. 194 + 64. This curious species is also remarkable for the changes which the colours undergo by age—pale reddish-brown, relieved by four ranges of ocellated spots, in the young; grey, inclining to olivaceous, or to brown or black, in the adult.

18. Coluber Sayi. From Missouri. Head very conical; vertical plate triangular in form; rostral salient; 25 rows of carinated scales; reddish-yellow, the back a deep brown; these colours form spotted bands. S. 224 + 55.

19. Coluber quaterradiatus. Sometimes of the length of seven or eight feet; lives in the south of Europe; head distinct from the trunk, very elongated, high near the eyes; muzzle thick; eye large, overshadowed by a projecting plate; occipital plates pointed; tail strong; 25 rows of small lanceolate scales. S. 212 + 75. Above brown, relieved by four brown rays more or less distinct; a dusky ray passes from the eye to the angle of the mouth. This Coluber is very gentle in its manners.

20. Coluber viridiflavus. From the same regions as last, but of a larger mould, more widely distributed, and more common. Tail very slender, and flat below; trunk almost cylindrical; abdomen convex; 19 rows of smooth

scales. S. 195 + 103. Above a deep green, below, and a central spot in the scales, yellow. These tints vary much, and often pass into brown, or even into black. This species is very wild in its manners.

21. Coluber Cliffordii. From northern Africa. The regions of the temples and frenals are covered with scales; the labial plates are narrow and numerous: scales carinated and disposed in 23 rows; tints livid; above, dull yellowish-brown, with three ranges of spots a little darker, and often confluent. S. 236 + 84. Less strong than the last.

22. Coluber Hippocrepis. Intermediate between the two last. Size and form of the Coluber viridiflavus, but the head is larger, and the tail less extended. The eye is surrounded posteriorly, and below with about six small plates; scales in twenty-five rows. S. 232 + 91. Colour reddish-yellow, very bright; the upper parts are relieved by three rows of large dark spots, orbicular on the back, square and smaller on the sides; the marks which ornament the top of the head, have sometimes the form of a horse-shoe. Inhabits most of the countries bordering on the Mediterranean.

23. Coluber florulentus, has a shape more delicate than the last. Colour a yellowish or brownish grey, varied with a great number of spots and bands very obsolete. Chin and temples garnished with numerous little plates or scales; nineteen rows of long scales. S. 214 + 93. Country, Egypt.

24. Coluber Trabalis.* A little more strong than our Coronella lævis, from which it only differs in its scales being feebly carinated: country, Tartary; twenty-five rows of scales. Pl. 195 + 75.

25. Coluber guttatus. From North America; of a more vigorous form than our Coronella lævis; it has also a smaller head, and a shorter tail. The abdomen is a little angular. Pl. 210 + 56. Twenty-five rows of smooth scales. Above of reddish-grey, speckled with black, and

* It is the Coluber Dione Pall. of the Berlin Museum, where our Psammophis Moniliger bears the name of Coluber Trabalis Pall.

relieved by three or five ranges of spots, of which the middle ones are very large, and more or less orbicular. A bifurcated black mark on the occiput, and a band between the eyes. Below deep yellow, with square, alternate, black markings.

COLUBER LEOPARDINUS.—System of colouring analogous to that of Coluber guttatus, with this exception, that the spots on the back are smaller, and often confluent. Shape more delicate than the preceding; head as in the Coluber Æsculapii; twenty-three rows of smooth scales. S. 240 + 75. Inhabits the south-east of Europe, and northern Africa.

27. COLUBER CONSPILLATUS.—Very analogous to the last, in the system of its colours, but with a more heavy shape; it has larger scales, and several little frenal plates; transverse bands instead of spots on the trunk; a club-shaped spot, preceded by an angular mark, on the occiput; twenty-one rows of scales. S. 210 + 68. Native of Japan.

The limits of the genus COLUBER, so rich in species, will some day be, no doubt, considerably extended, when we can arrive at a more accurate knowledge of the numerous species superficially indicated by travellers. I shall only quote the following:—(1.) COLUBER ATROFUSCUS of DAUDIN, vi. p. 285, rests on the authority of the delineation of the head and posterior of the body of a snake, mentioned by RUSSEL. (2.) COLUBER OBSCURUS of DAUDIN, vi. p. 363, established after RUSSEL, i. pl. 18. (3.) COLUBER PLINII of MERREM, *Tent*, p. 101; the COLUBER PICTUS of DAUDIN, vi. 347,—names which have for their type RUSSEL's pl. 29, vol. i.: this species is probably identical with the COLUBER TRISCALIS of LINNÆUS, from which the COLUBER CORALLINUS of the same author, figured in *Seba*, ii. pl. 17, § 1, appears not to differ; a good figure of COLUBER TRISCALIS is found in *Seba*, ii. 38, 3.—SCHLEGEL, part ii.

HERPETODRYAS

Is the sixth genus of Harmless Terrestrial Snakes. They prefer to live in woods, or usually frequent trees. They approach the genus Coluber in organization; but they have a more slender shape, their head is more elongated, and the greatest numbers present a livery of green, more or less uniform. Their habits are wild; they inhabit the warm districts of both worlds, but they have never yet been found in Africa, nor in New Holland. Europe and Japan do not furnish one species. Most of them feed on birds.

1. HERPETODRYAS CARINATUS. A serpent remarkable from its back being furnished with two rows of scaly plates along its ridge, making the whole rows of scales an even number, an instance unique in all the order of Ophidians. It is also remarkable, because all the parts are liable to considerable variations. The rows of scales are twelve, and the two dorsal rows are often surmounted by a strong keel. The scuta vary from 142 + 98 to 199 + 104. We find in this species several distinct varieties marked by their shape being more or less slender. Above brown, verging on green, on greyish-black, or on red; the back more clear; below yellow. Inhabits Brazil, and is very common in Surinam. Arrives at the length of six feet.

2. HERPETODRYAS SERRA. A very rare species from Brazil. Shape thin, trunk strongly compressed, back carinated, tail slender, abdomen angular, frontal plates narrow, scales strongly carinated, lanceolate, and disposed in twenty-one rows. Pl. 241 + 106. The last maxillary tooth long and grooved. A series of large square dorsal spots on a pale reddish-grey ground, which, on the tail, passes into black.

3. HERPETODRYAS VIRIDISSIMUS. — Head broad and compressed; abdomen very angular; nineteen rows of scales, with smooth and very shining surfaces. Size from two to three feet. Colour above, bluish-green, more clear below. S. 215 + 115. Inhabits Surinam.

4. HERPETODRYAS OLFERSII.—Form less slender than the former; the last labial plates broad; colour green;

the head and dorsal ray of a lively brown; a black stripe behind the eye; abdomen convex. S. 178 + 95. From Brazil and Surinam, where it forms a variety distinguished by a nearly uniform green colour.

5. Herpetodryas margaritiferus. Size and form those of Her. Olfersii; but it has a rather larger head; nineteen rows of scales, feebly carinated, black, with the centre blue, and the tip yellow; summit of the head a bright brown; temporal region black. S. 154 + 115. From New Orleans.

6. Herpetodryas Boddaertii. Nearly allied to Herp. Olfersii; but the abdomen is a little angular, the head more depressed, the labial plates more narrow, colour of a greenish-grey, or uniform olive. S. 170 + 102. From Surinam.

7. Herpetodryas æstivus. Distinguished from the three preceding species by seventeen rows of lanceolate and strongly carinated scales, by a more thin make, and by its fine grass-green colour. S. 175 + 130. Inhabits both Americas.

8. Herpetodryas tricolor. Habit of Herp. viridissimus, but of less size; its head also is shorter, thick at the base, and very conical; the trunk is less high, and the frenal plate is wanting; fifteen rows of square smooth scales; occipital plates much developed; above of an olive or brownish green; a black list passes from the eye to the sides of the neck. S. 150 + 115. Very rare in Java.

9. Herpetodryas Goudotii. Form very slender; tail extremely delicate; above yellowish-brown; on the flanks numerous black oblique streaks, produced by the borders of the scales; sides of the abdomen spotted with black, which forms a ray on the sides of the tail; twenty-one rows of scales, lanceolate and smooth. S. 186 + 158. Country, Isle of Madagascar.

10. Herpetodryas oxycephalus. Of a very vigorous make, and has the habit of a Coluber; trunk very compressed and deep; abdomen strongly angular; tail long and strong; head acuminated, especially the muzzle; frenal plate small, and very much elongated; twenty-five rows of lanceolate and smooth scales; green, below yellow,

tail brown. S. 250 + 140. Country, Island of Java. Celebes produces a climatal variety, distinguished by brown tints, which pass to black on the posterior parts.

11. Herpetodryas lineatus. A small species from Surinam, where it is very common. Whitish-grey, above brownish, with three dark rays; nineteen rows of smooth scales; eye large; vertical plate narrow. S. 170 + 70. Brazil produces an Ophidian perfectly analogous; but all its scales are bordered with black, and the interrupted dorsal rays are composed of black spots.

12. Herpetodryas Helena. A very beautiful species from Bengal, where it is very rare; scales small, smooth, and disposed in twenty-seven rows; form very slender. S. 230 + 90. Below of a pearly colour; above of a rosy purple, passing to brown towards the posterior parts; summit of the head of this last tint; a yellowish-green dorsal ray; on the nape a pair of blue claviform streaks, including a zig-zag line which is prolonged on the back.

13. Herpetodryas Rhodogaster. Colours above as in Herp. lineatus; below red; form much more slender than in the Herp. lineatus; but the head is rather large, massive, and covered with plates not well developed; frenal small; the number of abdominal plates 186, the caudal above 70; seventeen rows of smooth scales. Inhabits the Island of Madagascar.

14. Herpetodryas geminatus of Java.—Size small; form very slender; trunk cylindrical, everywhere of equal thickness; head small, of the same diameter as the neck, depressed, obtuse at the extremity; fifteen rows of smooth lozenge-shaped scales. S. 166 + 105. Marbled with dark greyish-brown. Two dorsal rays of a silvery grey; a yellowish half-collar on the nape.

15. Herpetodryas Psammophis.—Resembles the Coluber viridiflavus in habit and system of colours; but its form is more slender; the abdomen a little angular, and the head more lengthened; the physiognomy recalls that of the Psammophis; vertical plate elongated. S. 196 + 114. Seventeen rows of scales, which are lanceolate and smooth. Country, New Orleans.

16. Herpetodryas Dendrophis. — Fifteen rows of

lanceolate, carinated scales; the tail flattened below; belly convex. S. 140 + 196 ?* Above of an olive-brown, marked by numerous dark-coloured, narrow, transverse bands inclosing light-coloured spots. From Cayenne.

17. Herpetodryas Dipsas. Resembles the genus Dipsas in the form of its large head; eyes very large; scales smooth, large, and disposed in 13 rows: form thin, but vigorous; tail very slender; colour shining bluish-black. The lower and anterior parts are of a brownish-yellow, the last covered with marblings; triangular spots on the sides. S. 194 + 130. A species of large size; a native of Celebes.

18. Herpetodryas Getulus. Its clumsy form approximates it to the genus Coluber. Trunk thick; abdomen angular; head almost in the same line as the neck; muzzle truncated, rostral plate arched; eyes small. 21 rows of smooth lozenge-shaped scales; S. 210 + 44.† Black variegated by bands and rays of a yellow colour interlaced with each other. From North America.

19. Herpetodryas Cursor. Of a small size; form of a Coluber; lower part of the tail very convex; 16 to 17 rows of scales; blackish, with 4 yellow rays above. Pl. 195 + 105. From both Americas.

PSAMMOPHIS

Is the seventh and last genus of the Terrestrial Snakes. It comprehends those snakes which approach tree-snakes by their form, and by several points in their organization. The greatest number inhabit uncultivated plains, or sandy regions covered with bushes. They present an anomaly in the system of dentition, inasmuch as the posterior teeth and those in the middle are usually longer than the rest, and sometimes grooved. Their head is elongated, rather broad, and covered by plates, of which the vertical is very narrow; the frenal region is in the form of a gutter. Some have a slender shape and a small body; others, by their compact form, approach the genus Coluber. They inhabit

*[It probably should be 106.—Tr.]
†[This also seems an error.—Tr.]

the hot and temperate regions of both worlds, but they have not hitherto been observed in New Holland. They rarely attain a large size.

1. PSAMMOPHIS LACERTINA. Size larger, and form more heavy than in the other species. It is easily recognised by its scales having a hollowed groove, and at the summit of the head being concave, and separated in the form of a casque. Vertical plate very narrow; anterior frontals and occipitals small; above olive-brown or greenish, ornamented with 5 ranges of spots; below yellowish; labial and mental plates with broad green spots. S. 189 + 80. Inhabits most of the countries bordering on the Mediterranean.

2. PSAMMOPHIS MONILIGER. Of a less size, and less robust make than the preceding. Head less broad and more depressed; greenish-brown or olive-green, with a yellow dorsal ray; often two similar rays on the sides. The plates of the head ornamented with large obsolete spots. Varies extremely both in the form and the system of its colour. S. 136 to 170 + 62 to 125: from 15 to 17 rows of smooth scales. Country, all Africa, even to the Levant. The southern point of that continent produces a great number of varieties of this species, and an analogous race is found in the Isle of France.

3. PSAMMOPHIS PULVERULENTA. Of very small size; tail very short; grooved teeth, extremely large; head conical; muzzle convex, and rather short; vertical plate very narrow; reddish-yellow, varying to brown and to black; head rayed with black; a dark-coloured dorsal ray accompanied by a row of alternate spots. The tints vary in different individuals. S. 153 + 54. Bengal, Sumatra, and Java.

4. PSAMMOPHIS SEYCHELLENSIS. Head slender and depressed; muzzle truncated; 17 ranges of lanceolate and strongly carinated scales. Deep brown, varied with alternate black and white spots; a pale ray bordered with black passes from the lips to the sides of the neck. S. 188 + 107.

5. PSAMMOPHIS ANTILLENSIS. Shape slender; habit of Ps. Moniliger; head broad and conical; muzzle termi-

nated by a blunt point; the vertical plate less lengthened than ordinary. All the teeth of equal length; above yellowish-green, varied by five dark rays, which become less distinct by age; below yellowish. Size about 3 feet. 17 to 19 rows of lanceolate smooth scales. S. 190 + 122.

6. Psammophis Dahlii. Approaches by its very long and slender form to the Dendrophis. Abdomen slightly angular; head narrow and long, but furnished with plates more developed than in all the preceding species; eye large: two anterior ocular plates. All the teeth of equal length. A large supernumerary gland behind the lachrymal. Above olive-grey; four or five ocellated spots on the sides of the neck. Length 3 to 4 feet. S. 211 + 122. Native of Dalmatia; and is also perhaps to be found in Egypt.

7. Psammophis elegans. A very handsome and rare species from the western coast of Africa. Form very slender; muzzle lengthened, conical, a little turned up, and truncated downwards; above pale brown, with three obsolete rays; below four obsolete greenish rays on a yellow ground. S. 191 + 159. 17 rays of small lanceolate smooth scales.

8. Psammophis Temminckii. Unites the habit and massy form of a Coluber, to the physiognomy of a Psammophis. Abdomen narrow and angular; above of a clear brown, relieved by four dark rays; scales marked by one or more black spots. S. 180 + 105. From Chile.

In all probability, we should arrange in this genus the Condanarouse of Russel, a native of Ganjam; but which appears to me much allied to the Psammophis Moniliger, which is spread over almost all Africa.—Part ii.

The fourth *family* of Innocuous Serpents includes the *Tree-Snakes*. They are particularly adapted to inhabit the vast forests of hot climates. They are in very small numbers in Africa, and very rare in New Holland; Europe only produces anomalous species. They usually have a very elongated figure, pass the greatest part of the day on trees or on bushes, and feed on birds or on Saurian reptiles. The first genus of this family is

DENDROPHIS.

They may be considered as Colubri of an elongated and slender form. Their trunk is compressed; the abdomen, and even the tail, are ordinarily angular, and clothed with very broad plates; the scales, disposed in very oblique rows, have a lanceolate or even a linear shape on the neck; the tail is very slender; the head presents almost the same structure as that of the genera Coluber and Herpetodryas, but its form is much longer; the eye is large, the pupil orbicular. This genus is adorned with very vivid colours, and inhabits the warm regions of both worlds; it exists not in Europe, and is very rare in Australia.

1. Dendrophis Liocerus. Scales carinated, and disposed in 15 rows. The frenal plate is wanting. S. 155 + 145. Above of a bronze colour, passing, on the front parts, into green, and into white on the lower parts, with a black streak behind the eye. Teeth delicate, and of equal length. Extends from Martinique to Brazil, and to Chile.

2. Dendrophis Catesbyi. Much allied to the preceding, but differs in having 17 rows of smooth scales, in its greenish tints, and more slender tail. S. 170 + 184. From the Island of St Domingo.

3. Dendrophis aurata. Form more gracile than any other serpent; head very small; muzzle more short than usual; eyes large; abdomen convex; 13 rows of smooth scales. Dominant colour, gilded bronze. S. 144 + 158. Surinam; extremely rare.

4. Dendrophis picta. Found in every part of intertropical Africa and Asia, from Senegal to New Holland. Very subject to variation. Scales smooth; a range of dorsal scales, very broad in the form of plates. Angles of the abdomen salient and sloping. Above brown-bronze; sides of the abdomen marked by a yellow ray, bordered with black; below whitish; on the sides of the neck there are often oblique black and blue spots. S. 175 + 128.

5. Dendrophis formosa. Size and habit of the last; but its head and dorsal scales are larger; the eyes more voluminous; the occipital plates smaller; and the

ground tint is a fine, deep blue, relieved on the sides by two black rays. S. 180 + 140. Country, Java and Sumatra.

6. Dendrophis Rhodopleuron. Form more slender than the preceding species. Tail very flat below; head depressed; 17 rows of carinated scales; posterior maxillary teeth grooved; angles of the abdomen salient and sloping; of a pale reddish-purple, passing now into yellow, then into green or brown, and variegated more or less with black; below verging on yellow; the middle line of the under part of the tail marked by a black ray. S. 210 + 174. From the Island of Amboina.

7. Dendrophis ornata. Form a little less thin than ordinary; of a fine deep green, adorned on the back with yellow and red marks of various figures, and variegated with black, which occupies the edges of the scales; head with several yellow bands; angles of the abdomen extremely salient and sloping; 17 rows of smooth scales. S. 200 + 113. From Bengal and Ceylon to Sumatra and Java.

8. Dendrophis præornata. From Senegal. Allied to the last; but it has the abdomen almost convex, and the body less thick; citron-yellow, relieved on the back by three black rays, which are replaced on the neck and head by transverse bands and spots; below, greyish-purple; sides of the abdomen marked by a series of dark specks. S. 178 + 125.

9. Dendrophis smaragdina. Colour of a uniform brilliant green; 15 rows of scales, strongly carinated; angles of the abdomen very salient; posterior maxillary teeth very long. S. 165 + 133. Inhabits the Gold Coast.

10. Dendrophis colubrina. An anomalous species from the Cape of Good Hope, which recalls, by its lengthened but very vigorous form, the Herpetodryas, or even the Dipsas; head very thick, with aggregated plates, of which the anterior frontals are small; eye very large; a posterior maxillary tooth, long and grooved; 21 rows of scales strongly carinated; lung with an accessory lobe; greenish-brown, or deep olive; below greenish-yellow. S. 189 + 113.

The late M. KHUL has referred to our DENDROPHIS PICTA a serpent of Yemen, described by FORSKÄL, *Descr.*, p. 14, under the name of COL. SHOKARI. I cannot venture to appropriate this description, which rather seems to me to be drawn from an unknown Ophidian, intermediate between the PSAMMOPHIS and the DENDROPHIS: that of KHUL is drawn from the DENDROPHIS PICTA.—Part ii.

DRYIOPHIS

Is the second genus of Tree-Snakes. They are easily distinguished by their extremely lengthened muzzle, which is most generally drawn out to a point more or less salient. Their forms are very slender, the trunk very compressed, and the abdomen convex; most of them have either green tints, or the colour of bronze. The upper jaw ordinarily is provided with several teeth posteriorly, and in the middle, which are much developed and grooved. The scales have often a linear form, and the abdominal plates are very high. The eye is not large; in the first species the pupil is transversely elongated. This genus comprehends the true Tree-snakes, which inhabit the intertropical regions of Asia and the two Americas. We may establish in this genus two geographical subdivisions.

A. *The Dryiophis of the Ancient World.*

Dryiophis, properly so called, have the maxillary teeth grooved, and the pupil of the eye horizontally elongated.

1. DRYIOPHIS NASUTA. Found from Malabar and Ceylon to the Marianne and Philippine Islands. Scales smooth, of the dorsal range rather large; rostral plate prolonged into a point; grass-green; below paler; a yellow ray extends along the sides of the abdomen and the tail. S. 180 + 153.

2. DRYIOPHIS LANGAHA. A curious serpent of Madagascar. Muzzle prolonged in a fleshy appendix, half an inch in length, often sharp pointed, and sometimes compressed and enlarged in the form of a leaf; scales cari-

nated; colour of a clear brown, passing to yellow on the lower parts; form less slender than usual; belly slightly angular. S. 148 + 136.

3. Dryiophis prasina. Head conical; muzzle truncated; rostral plate with salient edges; labials very deep grooved teeth very large; scales smooth. S. 200 + 160. Native of Bengal, Cochin-China, Java, Sumatra, and Celebes: the individuals of this latter isle form a variety with more slender tail.

B. *The Pseudo-Dryiophis or Dryiophis of the New World*, with the teeth less developed, and pupil orbicular.

5. Dryiophis Catesbyi. Colour green; scales carinated; muzzle very compressed and very obliquely truncated at the point. S. 204 + 140. From Cayenne to Florida.

6. Dryiophis argentea. Form more delicate than usual; six plates on the upper lip; smooth scales. Colour silvery-white, speckled with a darker tint, and adorned on the sides and below with broad longitudinal rays of deep blue. S. 200 + 90. Inhabits Cayenne.

7. Dryiophis aurata, has a form more light still than the preceding; all the parts extremely delicate. S. 190 + 162. Of a fine gilded bronze colour, dotted with black and white. Found from Brazil to Mexico, and perhaps also in Florida.

DIPSAS.

The tree-snakes, in the genus Dipsas, are recognisable by their very thick, broad, and obtuse heads, their vigorous, but compressed, trunk, the pupil ordinarily vertical, &c. They have, however, the elongated form peculiar to animals of this family. Their scales are generally smooth and lanceolate; and we observe in many species, a dorsal range of plates, larger than the rest; the plates of the head very aggregated; abdomen convex; nostrils very open. Sometimes we find in the jaw a posterior grooved tooth. The Dipsas inhabits, by preference, the vast forests of Asia and intertropical America. Other parts of the world

are without them, or support species more or less dissimilar, and in very small numbers.

1. Dipsas dendrophila. Of large size, attaining a length of 7 feet; form very powerful; head very thick; posterior teeth grooved; a small accessory pulmonary lobe; 21 rows of scales, of which the dorsals are large. S. 220 + 102. Body of a fine shining black, surrounded with numerous bands of golden-yellow. Found in the Islands of Java and Sumatra; the specimens from Celebes have the yellow bands closer, and the occiput ornamented with several spots of the same colour.

2. Dipsas multimaculata. Habit of the preceding, but the size much less; teeth all of equal length; colour a grey-brown, or olive, varied with deep brown; on the sides 2 ranges of spots, the superior very wide; summit of the head marked by an angular line; a dark streak behind the eye; below of a rose colour, marbled and spotted with brown; 17 rows of smooth scales. S. 207 + 84. Inhabits Bengal, and is found also in Java and Celebes.

3. Dipsas trigonata. From Bengal. Allied to the last; but the posterior maxillary tooth very long; the tail shorter; colour of a yellow-olive, marked along the back with irregular triangular spots of white, bordered with black. S. 233 + 80.

4. Dipsas Cynodon. A beautiful serpent found in Java and Sumatra, of large size, and of a very attenuated form; trunk extremely compressed; 21 rows of scales; the dorsals large and hexagonal; teeth largest at the anterior extremity of the jaws; eye very large; colour of a greyish-purple, finely marbled or speckled with brown, and relieved with black, close-set bands; several white spots on the sides; a black streak behind the eye. S. 260 + 140.

5. Dipsas Drapiezi. Form a size nearly similar to the last; but the muzzle is much shorter, the trunk less high, and the teeth of equal length throughout. The frenal plate is usually wanting. S. 260 + 130. Below of a rose-purple, bordered with black; a series of red spots, bordered with black, near the abdomen. Of an almost uniform brown in the adult. Observed in Ceylon, Sumatra, Java, Celebes, and New Guinea.

6. Dipsas irregularis. Habit of Dipsas dendrophila. Of a strong make: dorsal scales of the same size as the rest; occipital scales very small; subcaudal plates often simple. Of an olive-brown colour, relieved by dark and narrow bands, which descend from the back obliquely backwards, but which are effaced by age. 23 rows of scales. S. 250 + 100. Native country, Celebes and Amboina.

7. Dipsas colubrina. Dorsal scales as in the last, which it resembles also in its tints; but it has a much less elongated form, a short and vigorous tail, a body surrounded with 27 rows of scales, and ornamented with six series of dark spots, disposed in a quicunx order. S. 183 + 67. Inhabits the Isle of Bourbon and Madagascar.

8. Dipsas Ægyptiaca. Allied to D. irregularis in habit and defect of large dorsal scales; but has a less strong make, a body less high, and a smaller head, which is very depressed and obtuse. It has but a single pair of mental scales, and a brown smoke-grey colour, with numerous pale obsolete bands. The scales are small, in 41 rows. S. 256 + 74.

9. Dipsas nebulata. Small size. Head very high; muzzle short and high; no frenal plate. Form less slender than usual; teeth delicate and comb-like. 15 rows of scales, with a smooth surface. S. 180 + 80. A range of dorsal plates. Pulmonary cells advance along the trachea; lachrymal and nasal glands much developed; body charged with brown and pale marblings; sides of the back ornamented with spots or bands; below yellow. From Surinam.

10. Dipsas Mikanii. Resembling the preceding, but with a head more lengthened, a muzzle very thick and rounded, a trunk less high, and dorsal scales less developed. Above of a yellowish-brown, marbled with brown, and varied with broad spots, or dark bands; end of the muzzle and collar white. S. 170 + 58. This species appears to replace the preceding in Brazil.

11. Dipsas Weigeli. Form exceedingly slender and delicate; head small, broad at the base, and conical; tail half the length of the trunk; dorsal scales very broad. S. 256 + 160. Above of a yellowish or reddish

white, speckled with brown, and relieved by a row of large spots of a reddish brown, bordered with black. Inhabits Brazil.

12. Dipsas Catesbyi. Has much similarity to the preceding; but its form is much less elongated; its muzzle is more broad, and truncated at the end; the gular plates are much developed; those of the head considerably wider; its scales are larger; the spots on the trunk are more extensive, and we may observe a collar and band of a light colour between the nostrils. S. 162 + 82. From Guyana.

13. Dipsas pavonina. Intermediate between the two last, in almost every respect. Head as in D. Catesbyi; but the tail is longer, and furnished with 134 plates or scuta; abdominal plates 217. Ground tint not verging to red; spots all oval. Appears with the last to represent the D. Weigeli at Guyana.

14. Dipsas Bucephala. Said to come from Sumatra. Very recognisable by its very deep trunk; by its small, but very broad, thick head, and by its extremely short muzzle; by the size of its dorsal plates; by the abdominal plates which advance just below the chin, &c. The plates of the head are very aggregated, and the frenals are absolutely wanting. Point of the lower jaw bent upwards. S. 200 + 105. Above of a reddish-brown, relieved by numerous wide transverse bands of reddish-yellow, varied with brown.

15. Dipsas Dieperinkii. Of middle size. Trunk high, more thick towards the head, which is proportionably larger than in any other species; 21 rows of scales feebly carinated; abdomen a little angular; pupil of the eye round; teeth of equal length; tail lengthened and slender; above clear brown, with angular markings; below verging on yellow; a fine line behind the eye. S. 224 + 150. From Surinam, where it is among the rarer species.

16. Dipsas Boa. A curious and odd species, remarkable for the smallness of the plates on the top of the head, which are raised and convex; for its very short muzzle, which is narrow and conical; for the presence

on undivided scuta below the tail; for a circle of small ocular plates; for a large eye, with a round pupil; and for very large mental plates. There are several long teeth at the extremity of the lower jaw. S. 154 + 98. 13 rows of smooth scales, with the dorsals very large. Above of a grey-purple, relieved on the flanks by about twenty broad spots of a rose colour. Inhabits the interior of the Isle of Java.

17. Dipsas carinata. Of small size. Head extremely wide and thick; muzzle rounded and shorter than in any other species; lips projecting and curved; eyes surrounded by four plates; geneial plates very voluminous. 15 rows of carinated scales, with the dorsals rather broad and truncated at the tip; teeth delicate and comb-like; bone of the cranium small. S. 168 + 60. Above of a marrone-brown, with dark close-set bands; a mark with four points on the neck. From Java.

18. Dipsas lævis. Also from Java. Of smaller size than the last, to which it has a resemblance, except that it has all its features less marked, the form more heavy, and the tail shorter; that the body is covered with smooth scales; that it wants the frenal and inferior ocular plates; and that the occipitals are surrounded with a row of other smaller plates. Of a deep brown colour, relieved on the upper parts by black transverse bands. S. 158 + 37.

19. Dipsas leucocephala. Scales of almost the same size, slightly truncated at the tip, and disposed in 19 rows; abdomen faintly angular. Above of a grey-purple, marbled with brown, and varied by about 50 dark transverse bands; form very slender. S. 244 + 108. From Brazil.

20. Dipsas macrorhina. Of a considerable size. Form thin, yet robust; head very thick; muzzle very broad, almost of equal diameter with the trunk, rounded; nostrils extremely open; rostral plate advancing on the top of the muzzle; anterior frontals small; 19 rows of scales strongly carinated. S. 271 + 118. There are grooved posterior maxillary teeth. Body marked with alternate rings of black and white; a white collar. Native of Cayenne.

21. Dipsas Nattereri. Departs from the other species of Dipsas by its head, of which the shape approaches that of the Dendrophis. The muzzle, however, is short and narrow, and the pupil of the eye vertical; plates on the muzzle small, those of the top of the head long and narrow; 17 rows of lanceolate scales, surmounted by a carina, and of the same size throughout; a posterior maxillar tooth, larger than the rest. Of small size; brownish; back with four dark rays. S. 168 + 74. From Brazil.

22. Dipsas punctatissima. Size, habit, and form, absolutely like the preceding; but the scales are smooth, the tail more slender, the tints clearer, the vertical plate more elongated, and the eye smaller. S. 150 + 90. Inhabits the regions to the north of the river of the Amazons.

23. Dipsas Gaimardii. A very beautiful species, from the Island of Madagascar; has a form very slender, and extremely delicate; body somewhat high; sides of the tail slightly angular; head rather small; 17 rows of scales all of equal size. S. 276 + 116. Of a pale purple-brown; a great number of transverse bands on the back; often accompanied by spots on the sides.

24. Dipsas annulata. Resembles the preceding by its colours and physiognomy; but its form is much more heavy; the head more voluminous, the tail shorter. S. 186 + 89. Occurs from the Paraguay as far as New Orleans.

25. Dipsas fallax. A singular species, which approaches the Coronellæ. Like the last, but more robust, and with a shorter tail; the occipitals are also smaller, the head less high, and the eye less large. The frenal plate is elongated, and reaches to the eye; a long grooved tooth exists at the posterior part of the jaw; 19 rows of smooth scales. S. 206 + 55. From Dalmatia to the Levant. Above grey-brown, marked with black, and set off by several ranges of broad dark spots. A cruciform spot on the nape of the neck.

The *Fifth Family of Innocuous Snakes* includes the

Fresh-Water Serpents. These serpents approach by their organization more or less to the Colubri, and live in the water, or at least prefer the neighbourhood of rivers or of lakes to other places. I do not mean to say that all the Ophidians which have similar habitudes should be united to this family, otherwise it would oblige us to range in it the Colubri, and most of the Boas, which present a very different organization. I have rather assembled under this appellation the serpents of which I am to treat; because, with certain analogies in their organization and physiognomy, they compose a natural group, but by no means separated by precise characters from other subdivisions. This family comprehends two genera, the first of which, with some slight exceptions, presents nothing interesting in the structure, while the species of the second are all characterized by peculiarities as marked as curious. The first is the

TROPIDONOTUS,

which constitutes an assemblage of serpents, very analogous to the genus Coluber, but the forms of which are more heavy; which have the belly very broad and convex, the head broad and conical, but narrow at the summit, with a short muzzle. The eye is not large, and the nostrils are but little open. These snakes have ordinarily 3 plates behind the eye; 19 rows of scales, of a lozenge form, and carinated, the angle of the mouth turning upwards. The colour of the Tropidonotus is often sombre, but varied with spots of vivid hues; they do not arrive at a great size, and most of them do not surpass 3 or 4 feet in length. They inhabit the vicinity of freshwater, or even in the water, and are very good swimmers. Living in society, they are common in the places they frequent; and the genus is rich in species. They have not yet been observed in New Holland, nor in South America, where they are replaced by the Homalopsis. Southern Africa supports but a single species, remarkable by its anomalous organization.

1. Tropidonotus Natrix inhabits the whole of Europe

almost to Siberia. It is a very common snake, and universally known; recognisable by its bluish or greenish colour relieved by black spots, which become square on the lower parts, by its whitish collar, succeeded by a broad dash of black. Individuals are found wholly black; and in the south of Europe it rarely has been seen with a yellow ray down the back. S. 163 + 62. Lives near, or on the borders of, lakes or rivers, and often establishes itself in the vicinity of houses.*

2. TROPIDONOTUS QUINCUNCIATUS. A large and handsome species, of an olive-brown, ornamented with 5 or 7 ranges of spots disposed in a quicunx order. An oblique streak on the temples, another under the eye. Tints very subject to variation, either accidentally or through the influence of different climates. Individuals from Java have the spots confluent on the upper parts to form longitudinal rays; those of the Marianne Islands have the abdomen speckled with black. Found from Malabar to the Philippines and the Mariannes. S. 134 + 72. Nostrils rather vertical; anterior frontal plates conical.

3. TROPIDONOTUS UMBRATUS. Yellowish, varied with black; whole head black. S. 142 + 83. Native country, Bengal and Ceylon.

4. TROPIDONOTUS RHODOMELAS. As beautiful as rare; above of a brisk-red; below more pale; back ornamented with a dark ray; on the sides a series of black specks; head very broad and thick; muzzle short and conical; occipital and frontal plates small. S. 131 + 44. Island of Java.

5. TROPIDONOTUS TRIANGULIGERUS. Deep olive-green; below of an olive-yellow; sides ornamented with broad triangular red spots; muzzle longer and more conical than in the preceding species. S. 137 + 81. Inhabits Java.

6. TROPIDONOTUS CHRYSARGOS. Form very similar to the last; but the size is rather less, the muzzle less conical, and the sides varied with black bands and yellow spots.

* [Though exceedingly common in England and Wales, it has never been seen by the Translator in Scotland; nor can we find any satisfactory evidence of its ever having been caught in this kingdom, although the common Viper is abundant in many parts of Scotland.]

Below of a rosy-purple. S. 176 + 81. Inhabits the Island of Java. A handsome local variety of an uniform colour is found at Celebes; another with vivid tints at Sumatra.

7. Tropidonotus subminiatus. Allied to the two last by structure, habit, and shape; but the head is shorter and higher, and the upper lip very inflated. Brown verging on green, on red, or on black, and varied with black; below yellow, with two rows of black points; naked skin of the neck or space between the scales, of a fine vermilion-red; on the nape a black spot, preceded by a yellowish collar. S. 131 + 57. From Java.

8. Tropidonotus picturatus. A new species from New Guinea; size considerable; form less strong than the last, which it resembles in habit and form of the head; 15 rows of scales. S. from 128 + 52 to 134 + 62. Above of a brown shistose-black; below of pale citron-yellow; the scuta have reddish edges, and a large spot of smoke-black on the ribs; two rays of black on the neck, and another behind the eye; lips yellow.*

9. Tropidonotus tigrinus. Habit, physiognomy, and colour, like the Tropid. Natrix; but the head is less depressed, the scales are broader and more strongly carinated, the eyes larger, the dorsal spots more extensive in the species of Japan. S. 161 + 71.

10. Tropidonotus Vibakari. Of very small size, and of very slight form. Head small, and not distinct from the neck; the scales feebly carinated. Pale brown, with a dorsal ray of a deeper colour; below more clear; a white collar; labial plates whitish, bordered with brown. S. 142 + 74. Total length 16 inches. Like the preceding, from Japan.

11. Tropidonotus Stolatus. Size a little larger, and form less delicate, than the last; physiognomy recalls that of T. subminiatus. Above deep olive-brown, relieved by a reticular design formed by two yellow rays, intersected by black bands, and marked at the angles with

* [This species is omitted in the Synoptic Table, but it is described more fully in the descriptive part of M. Schlegel's work.—*Tr.*]

white spots. S. 146 + 61. From Malabar to the Peninsula of Malacca; also inhabits the Philippine Isles.

12. TROPIDONOTUS VITTATUS. Abounds in the inundated parts of the Island of Java. Size and form nearly as the preceding. Livid brown, relieved by three black rays; a ray of pale red on the last row of scales. S. 144 + 78. Of a slate-blue, bordered with black.

13. TROPIDONOTUS SCHISTOSUS. Above of a slate-grey; below yellowish; size less than that of the T. Natrix; head short and conical, with aggregated plates; eyes small; scales surmounted by a very strong carina. S. 150 + 80. Observed in Madagascar, Bengal, and the Philippines.

14. TROPIDONOTUS BIPUNCTATUS. In many respects resembles our T. Natrix, especially the variety of Southern Europe; but it has a more lengthened head; the eyes are smaller, the collar and the spot on the neck are wanting. Above marked by irregular transverse spots. Abdominal plates have a black spot. S. 141 + 67. Country, Martinique, Florida, Carolina, Mexico, &c.

15. TROPIDONOTUS SAURITA. In colour and physiognomy it presents a striking analogy with the preceding; but differs from it, as from all the others of the genus, by its slender form, which approaches to that of the Herpetodryas; head more elongated than ordinary. Ground colour a deep brown, relieved by longitudinal rays of black. S. 166 + 111. Country, North America and Martinique.

16. TROPIDONOTUS FASCIATUS. Attains a very large size. Head a little more than usually elongated; scales strongly carinated; eye rather large; nostrils narrow, and almost vertical. S. 136 + 65. Greyish-brown, relieved by deep, broad, round spots, which are often confluent; yellow below. Inhabits the same countries as the two preceding.

17. TROPIDONOTUS VIPERINUS, of the south of Europe, is found in the Barbary States, and even as far as the Caspian Sea. Head more lengthened than in the other species; very conical, and covered with more narrow plates. Above of a brownish-green, marked with

several rows of dark spots; below yellow, with square black spots. Spain produces a pretty variety, with yellow dorsal rays. S. 186 + 68.

18. TROPIDONOTUS SCABER. This is one of the most curious serpents, in this respect, that the extremities of the anterior spinous apophyses of the vertebræ of the neck, in the shape of teeth, penetrate the tunics of the œsophagus. The lachrymal gland, of an extraordinary size, extends to the angle of the mouth. In other respects, this serpent does not differ in any remarkable degree from the other Tropidonoti. Its head is very thick, short, clumsy, and covered with plates of a short form; the frenal is wanting. The scales, disposed in 25 rows, are surmounted by a carina more distinct than usual. The trunk is elongated, and the tail short. S. 200 + 45. Teeth small, and of equal length. Comes from the Cape.

19. TROPIDONOTUS MORTUARIUS. Head elongated; nostrils and eyes very small, and almost vertical; anterior frontal plates and superciliaries small; several anterior oculars; 23 rows of scales, surmounted by a very strong carina. Colour almost the same as in the Tr. quicunciatus, but more numerous. It forms the passage to the genus Homalopsis. Comes from Bengal. Pl. 137 + 70.

HOMALOPSIS.

This is the second and last genus of Fresh-Water Serpents, and merits, in all respects, that designation. They have forms generally clumsy, and massive, and their head has a physiognomy wholly peculiar, although this organ has an organization very different according to the species; it is very thick; has a short and rounded muzzle, is covered by scaly plates, usually very numerous, and more or less irregular in shape. The peculiar physiognomy of the Homalopsis is due, in a great measure, to its small eyes, more or less vertical, and to the nostrils directed upwards, and in the form of a crescent, which are so near together, that we usually find but a single

anterior frontal plate. The lips are much inflated, and re-entrant; the angle of the mouth is very ascendant. We find usually long posterior maxillary teeth, often grooved; and the glands of the head are very large. The skeleton is composed of very strong bones; and the cellules of the lungs are often prolonged on the trachea. Most of them exhibit sombre tints, and arrive at a large size. The Homalopsis have never been seen except in the warm regions of Asia and America, where they inhabit the fresh waters in small numbers, giving chase to fishes and other aquatic animals.

1. HOMALOPSIS BUCCATA.—Strongly characterized by a head extremely thick and high, by the great number of labial plates, by the small, feebly carinated scales, of which 39 rows are reckoned.

There exist small occipital plates, and an anterior frontal, single on account of the disposition of the nasals, which encroach on the summit of the muzzle. A circle of little plates surrounds the eye. Four or five pairs of converging geneials; the rest of the throat covered with scales; posterior maxillary teeth grooved; cheeks much inflated. Above of an ochre-yellow, covered with large blackish bands. A series of dark points runs along the sides of the belly. Summit of the head ornamented with streaks. S. 160 + 78. Form heavy; shape powerful. Inhabits Java.

2. HOMALOPSIS SCHNEIDERI.—Of a less size, and a form more lengthened than the preceding, which it resembles in its profile; but it has a head much more elongated, and the summit covered with scales similar to those on the trunk, so that there are no plates on the muzzle, 25 rows of carinated scales. Eyes directed upwards. 146 + 57. Inhabits Pondichery, Bengal, Java, Timor, Amboina, and also New Guinea.

3. HOMALOPSIS DECUSSATA.—Of very small size; 19 rows of smooth scales; tail very thick; head small, of the same diameter as the trunk, rounded at the extremity, and covered above by 9 plates. Body marked by alternate bands of reddish-brown and white; this last tint

forms the collar, and a spot on the muzzle. S. 136 + 30. Inhabits Java.

4. Homalopsis Leucobalia.—A species remarkable by the form of its head, which is very large, thick, and high, rounded at the narrow top, which is covered by 8 small plates; the eyes are very small, and the upper labial plates only amount to 5 in number; one anterior and two posterior oculars; 25 ranges of smooth, lozenge-shaped scales. Above blackish; irregular bands on the sides; below whitish. S. 154 + 33. Form very heavy. Inhabits the island of Timor.

5. Homalopsis plumbea.—Form less thick than in the preceding. Head broad and rounded, with 8 plates on the summit; 19 rows of smooth and square scales; tail much concentrated. From Java. S. 121 + 37. A grooved, posterior maxillary tooth. Above leaden coloured, below whitish.

6. Homalopsis Aer.—Very analogous to the preceding, but the head more elongated; the muzzle less broad, small, and covered by smaller scales; trunk more compressed, and the tail more slender. 25 rows of lozenge-shaped scales. S. 148 + 52. Colour leaden, verging on brown, with two pale dorsal rays; sides yellow, with a dark-coloured ray. It is found in Java and Bengal.

7. Homalopsis Sieboldii.—Trunk more than usually compressed; back very angular, from the strong carina which it forms; abdomen very narrow; 29 ranges of smooth scales; form massive; head almost as in H. buccata, but less obtuse, with a more narrow summit; labial plates less numerous; the eye larger; there are also two anterior frontals. Above of greyish brown, verging on purple: a colour almost covered by several series of very large dark spots; below yellow, marbled with brown. S. 147 + 51. From Bengal.

8. Homalopsis carinicauda.—Inhabits both Americas. Allied to H. plumbea of Java; but it has a head more lengthened, and a more slender tail; also a more ample eye, and the scales are truncated at the tip, and surmounted by a strong keel, though only visible on the posterior parts.

Colour above, a deep leaden hue; below yellowish, with two middle rows of blackish spots. S. 137 + 56.

9. HOMALOPSIS ANGULATA.—Habit of a Tropidonotus, but it has a more massive form; head large and rounded, covered by 8 rather small plates; the single frontal advances between the nasals; eyes more than usually large; 19 rows of scales, strongly carinated. Yellowish, passing to red on the sides; above varied by very broad angular spots of a deep colour, with their points prolonged downwards, to form square alternate spots. Posterior teeth without a groove. S. 118 + 66. Lung simple. From the river Amazons to Martinique.

10. HOMALOPSIS PLICATILIS.—Well characterized by its very long and narrow head, but with a muzzle of remarkable shortness; by its large, blunt, smooth scales disposed in 15 rows; and by its colours. The frenal plate wanting; shape very vigorous; trunk very thick and cylindrical. S. 134 + 38. Above of a brownish red; on the sides a very broad dark ray, accompanied by a series of spots; below yellowish, with two rows of brownish points. From Brazil; a very pretty variety of it exists at New Orleans, characterized by its vivid tints.

11. HOMALOPSIS MARTII.—Head nearly as in H. plumbea, but more depressed and more lengthened; eyes very small; nostrils very near the end of the muzzle; trunk much more slender than usual, and cylindrical; 15 rows of smooth scales; body surrounded with rings of brown, alternately of two shades; the adults are of an almost uniform black, and have a very shining skin. S. 158 + 48. From the river Amazons to Surinam.

12. HOMALOPSIS REINWARDTII.—Of large size, and of an elongated form; tail very short and thick; 21 rows of smooth scales; all the trunk of nearly equal thickness, and a little compressed; physiognomy like that of H. plicatilis. Above blackish red-brown, below reddish yellow: these two tints interlace on the sides, to form bands and spots. S. 180 + 42. Discovered in Louisiana.

13. HOMALOPSIS LEOPARDINA.—Allied to H. angulata by the structure of the scales, to H. plicatilis by the form of the head. A single frontal plate wedged between the nasals; of a reddish brown, relieved on the upper parts

by five series of spots in a quicunx; tail lengthened in proportion to the dimensions of the trunk. S. 117 + 73. Country unknown.

14. Homalopsis Herpeton.—An entirely anomalous species, and one of the most remarkable of serpents for two fleshy appendages, which proceed from the point of the snout, and are covered with scales. Abdominal plates scarcely exceed in breadth the scales, and each is surmounted by two keels; 35 rows of scales strongly carinated. Habit, size, and form of H. Schneideri, but the trunk is very thick in the middle; the head covered with small scales, and on the crown by 9 plates, among which we may observe several scales of an irregular form. Teeth of equal length. S. 140 + 96. Brown, rayed with a light colour. Country unknown.

I have included the Boas in the *sixth family* of innocuous serpents. They have a prehensile tail, and also the faculty of entwining themselves round any object with their trunk. Their scales are numerous, and the plates on the lower parts are very little developed. The head is thick, with strong features, and covered with scales, or with small plates, of which the form and disposition are very dissimilar; they eyes are small, and usually have a pupil horizontally elongated; the nostrils are more or less vertical; the labial plates are often hollowed out by several fossettes; the lung is usually divided into two lobes, and there is a hook at the anus. The species inhabit the warm regions of both worlds; they are not numerous, and most of them surpass all other snakes in their dimensions. Several species frequent fresh water; others inhabit forests; and there are some of them essentially aquatic. They have the habit of crushing their prey in the folds of their bodies, and of breaking its bones before swallowing it. This family divides itself into three generic groups.

BOA.

The first genus is the *Boa, properly so called.* In this species the intermaxillary bone is unprovided with teeth,

the orbit is formed, as in other Ophidians, above by the middle frontals ; and the under part of the tail is furnished with simple plates. The genus is more especially proper to tropical America. Those of the ancient world, are of small size, and of dissimilar forms.

1. Boa Constrictor.—A terrestrial species of a size between 9 and 12 feet. Very distinguishable by the small smooth scales, which cover the body and the whole head, and are arranged in 67 rows, by its reddish tint relieved by a design composed of broad oval spots, of interlacing bands, and rays of a reddish brown. Form very powerful; tail short; head heart-shaped. S. 243 + 58. Inhabits the forests of intertropical America, where it suspends itself to the branches of trees, to possess itself of the small mammifera on which it feeds.

2. Boa Murina.—The largest of known serpents. Nostrils vertical, approximated to the end of the muzzle ; that part and the lips covered with plates. Eyes directed upwards ; 47 rows of smooth scales ; head elongated, muzzle rounded, and much inclined at the sides. S. 250 + 66. Fuliginous brown, with two rows of orbicular spots on the back, and a double series of ocellated spots on the flanks. An aquatic and viviparous species, which attains a length of even 20 feet. Same country as the last.

3. Boa Cenchria.—Of less size than the two last. A terrestrial species, with the habits of the Boa Constrictor. Head almost as in the two last, but the labial plates are hollowed into a gutter, and the vertical plates are replaced by small scales of an irregular form ; tail short ; nostrils open and lateral ; 35 rows of smooth scales. S. 240 + 48. Of a yellowish red-brown ; above ornamented with a double suite of orbicular spots, bright, and bordered with black ; three rows of spots, less broad, and dark coloured, on the sides. The spots are often confluent, forming a reticular design. Country the same as the preceding species.

4. Boa Canina.—Well characterized by its green tints, relieved by white lozenge-formed, dorsal spots ; below yellowish. Anterior teeth very long ; body strongly compressed, and particularly adapted for being rolled inwards ;

tail prehensile, endued with great power. Head heart-shaped, covered on the top with scales of an irregular shape, largest toward the point of the muzzle. All the labial plates are hollowed by fossettes ; 53 rows of smooth scales. Size about six feet. S. 196 + 70. From the river Amazons to Surinam.

5. Boa hortulana. — Distinguishable by its slender form, its very long tail, by a large hollow in its cheek ; small fossettes or grooves may also be observed on the posterior plates of the lower lip ; the anterior teeth are larger than the rest ; head heart-shaped, irregularly clothed with scales above ; but one pair of broad frontals, two frenals, and one anterior ocular plate ; trunk much compressed ; abdomen a little angular, and covered with scuta broader than usual in the genus ; 39 rows of long smooth scales ; reddish brown ; a series of broad dark spots, orbicular or lozenge-shaped, and of considerable size, on the sides ; disposition of the tints little constant ; head ornamented with a great number of dark vermicular markings. S. 273 + 117. Probably frequents trees, lives on birds, and inhabits all Brazil, Surinam, and has also been observed in the Isle of St Vincent.

6. Boa Dussumieri.—From the ancient world, a native of a little island near the Mauritius ; form slender ; tail long, as in the B. hortulana ; but the labial plates are without the fossettes. It has 39 rows of carinated scales ; the head much elongated, and clothed with scales, except the muzzle, which has a pair of plates on its upper part ; tail but little prehensile ; the rostral is obliquely truncated ; the eyes lateral ; nostrils narrow, and a little vertical. S. 238 + 128. Size much less than the South American species of Boa. Above brownish grey, with a few spots on the nape ; below yellowish.

7. Boa carinata.—A very small species from the Moluccas and New Guinea. Head rather long and depressed ; muzzle angular at the sides, and truncated at the end ; these parts covered with scales, with the exception of the frenal region and the lips ; nostrils and eyes lateral, the last projecting ; abdomen convex, aud covered by plates wider than usual ; several long maxillary teeth

in the front of the mouth; of a reddish brown, varied with white marblings and dark spots, which are confluent, often forming dorsal rays; 27 rows of strongly carinated scales. S. 170 + 50.

8. Boa conica.—Little known. From Bengal. Size of the preceding; tail very short and conical: deep brown; a large black ray, bordered with white, winds along the back; on the sides a series of dark orbicular spots; below of a pearly hue. S. 209 + 19.*

9. Boa Melanura.—An anomalous species, approximating the Boa to the Tortrix. Size and habit of the species of the ancient world; form massive; head covered by nine rather small plates; no hooks at the anus; tail very short, and strongly prehensile; 25 rows of carinated square scales. S. 206 + 38. Yellowish grey; a series of black spots on the sides, near the belly; another series of very obsolete spots on the back; the spots are confluent on the tail, giving it an uniform black tint; below, clear ochre-yellow.

PYTHON.

This is the second genus of the *Boa Family*. It consists of serpents of large size, exclusively inhabiting the Old World. They have the intermaxillary provided with teeth; the arch of their orbit is completed by a supernumerary bone, which does not exist in any other serpent; and the subcaudal plates are found to be divided. The lips are always furrowed with fossettes, and the plates of the head are more developed than in the genuine Boa.

1. Python bivittatus.—The rostral, and the two first labial plates only, are hollowed by fossettes; muzzle and top of the head covered with irregular plates; frenal regions excavated; 63 rows of smooth small scales. S. 270 + 70. Of a yellowish tint, relieved by a design composed of broad, alternate, brown spots; summit of the head bordered by two rays, forming the ground tint; sides varied and chequered with black and white; below with dark square spots. From the western coast of Africa,

* [A small specimen is in the possession of the Translator.]

through all intertropical Asia, as far as Java and China. The largest serpent of the ancient world, attaining a length of twenty feet.

2. PYTHON SCHNEIDERI.—Form much more slender; head much shorter, and size less than the preceding; head narrow, covered with plates more than usually developed; muzzle turned up at the end; anterior labial plates channelled by a groove; the last plates of the lower lip are equally provided with a groove; scales of the trunk very small. S. 320 + 90. Yellowish grey-brown, with a middle black ray on the top of the head, which extends to the body, interlacing with other rays, and thus forming a reticular design. Grows to fourteen feet, and inhabits Malacca, Java, Sumatra, and Amboina.

3. PYTHON AMETHYSTINUS.—Plates of the head more developed than in the other species; the labial grooves nearly as in the preceding; form more than usually slender; 41 rows of scales. S. 300 + 96. Variegated with reddish brown and yellowish tints, which often form an obsolete reticulated design; size about six feet; comes from Saparua, a little isle in the group of Amboina. The islands of Timor, Samao, and New Ireland, produce a Python almost absolutely similar, except that the characters are less marked.

4. PYTHON PERONII.—From New Holland. Size about six feet; head much broader than in the other species; nostrils very spacious, and directed upwards; muzzle very obtuse; upper part of the head is covered with numerous scaly plates, irregular, and larger towards the extremity of the snout. Fossettes in the lips, as in the preceding species; 41 rows of smooth scales. S. 275 + 83. Black, sprinkled with markings and dashes of golden yellow, more or less large, according, as it would seem, to the places it inhabits.

ACROCHORDUS

Is the third genus of the *Family of Boas*. These Ophidians are very singular and anomalous in their organization. They are, however, *Boas*, though anomalous Boas.

They have a tail strongly prehensile, and compressed like their trunk. They want the crochets at the anus. They have rounded heads; the eyes are extremely small, a little vertical, the pupil orbicular, the nostrils are tubular, near the top of the muzzle, and directed forward or upward. All their bodies are covered with very minute scales, not imbricated, mucronated; and there is on the middle line of the belly a projecting ridge, bristling with scales. The upper part of the orbit is formed by an apophysis of the posterior frontal bone. Teeth as in the genuine Boa. They are essentially aquatics, inhabit the East Indies, and have very sombre colours. Lung prolonged to the very anus. We know only two species of this genus.

1. ACROCHORDUS JAVANICUS.—Found in the rivers of Java. Length eight feet, and of a very clumsy form; nostrils directed forward; dark brown, charged with numerous marblings; cranium of a bizarre shape, from the shortness of the anterior part, the smallness of the mastoid bones, and the great length of the tympanites.

2. ACROCHORDUS FASCIATUS.—Form much more slender, and size far less than the preceding species; scales of the lips more developed; nostrils almost vertical; colour brown, with pale bands on the sides. Found in India, as far as New Guinea.

The ACROCHORDUS comprehends the genus CHERSYDRE of CUVIER, established after specimens of middle age. To the same category belong also the ACROCHORDUS FASCIATUS and DUBIUS of SHAW, the HYDRUS GRANULATUS of SCHNEIDER, which DAUDIN has converted into a PELAMIS. —SCHLEGEL, Vol. ii.

[The Acrochordus has been caught at Pondichery, in Timor, and Sumatra. The specimen of A. FASCIATUS in the British Museum is only 18 inches.—TR.]

II.—VENOMOUS SERPENTS

Form the second grand *division* of Ophidians. They are all provided with a murderous tooth or *fang*, fixed on the maxillary bone; of which the size is so reduced, that it rarely carries any other tooth than the *fangs*. This division naturally arranges itself into three groups or Families.

Colubriform Venomous Serpents form the first of these, including all those venomous Ophidians that by their form approach the non-venomous terrestrial serpents, to which they have usually a very striking resemblance, and are often distinguishable from them by no external sign, except the thickness of their muzzle. They have the trunk elongated, the tail short, massive, and conical, the eyes a little voluminous, and the pupil orbicular, the nostrils open and lateral. Their scales are large, lozenge-shaped, and almost always smooth. Their head is invested with plates like those of the genus Coluber; the rostral is sufficiently developed, while the frenal is ordinarily wanting. The venomous apparatus is usually little developed; the maxillary bone is long, and often armed with teeth placed behind the fangs, which last are short but strong, and provided with a groove uniting the orifices; the lower jaw, with its suspensory pieces, is little developed. These Ophidians inhabit the hot countries of both worlds; they are not found in Europe, and only form three genera.

ELAPS.

This genus has a cylindrical trunk, very slender, and of equal thickness throughout, surrounded usually with 15 rows of broad and smooth scales; the head elongated, and little distinct from the trunk; tints, for the most part, vivid and beautiful. They frequent wooded places, or coverts of grass, and seem to shun arid soils. They inha-

bit both worlds, and form a natural group, in which we may establish several geographical divisions.

A. *American species ;* which have the body marked by alternate rings of red and black.

1. Elaps corallinus. Head slightly conical; occipital plates rather broad; arrives at a length of four feet or more, has the thickness of a man's finger; summit of the head black, colours very subject to variation, as are also the scuta, which in some individuals are 178 + 25, in others as high as 222 + 45 ; ground colour red or yellow, with white or brown: rings often obsolete, and only recognisable by their white borders. From Brazil to Carolina.

2. Elaps Lemniscatus. Scarcely distinct from the last. Comes from Guyana. Form a little more slender; eyes smaller and less lateral; a black band between the eyes; rings on the body black, and usually approximated three and three. S. 230 + 36.

3. Elaps Surinamensis. Easily distinguished by its broad, short, depressed head, covered with rather small plates, bordered with black; muzzle obtuse; form squat, the body surrounded with rings approximated three and three, of which the middle is very broad ; the dorsal scales a little larger than the rest. It arrives at a very large size, and inhabits Dutch Guyana. S. 168 + 33, or 182 + 37, sometimes six feet long and nearly two inches thick.

[4. Elaps Jamesoni.—The only specimen hitherto described, is in the possession of the translator. A specimen without a head is in the British Museum. This beautiful serpent has the general habit of a Coluber : but the fangs and complete poison apparatus, as well as the nasal fossulæ, prove it to belong to the genus Elaps of our author; unless we were to consider it justifiable, for a single species, to institute a new genus. The total length, 6 feet, 1.5 inches ; length of head, 1.3 inches ; body, 4. f. 4.7 inches ; tail, 1. f. 7.5 inches. Circumference of body where thickest, 4.5 inches. Colour above fine bluish-grey ; where deprived of the cuticle, of a brilliant sky-blue. Scales smooth, large rhomboidal, on posterior of the body and tail edged with jet black ; lower parts yellowish white ; scuta wide ; near anus, and on the

tail they are edged with black. Sent from S. America. Pl. 220 + 108.—*See Jameson's Journal.—Tr.*]

B. *African species*, only one is known.

5. Elaps Hygeiæ. Easily to be distinguished by the artificial character drawn from the presence of an undivided nasal plate, pierced by the nostrils; vertical rather elongated; six labials; abdominal plates less broad than ordinary. S. 200 + 28. Of small size; inhabits the Cape; tints of great beauty; yellowish; above of a vivid red, ornamented with black bands, sometimes confluent; below mottled with black.

C. *Asiatic species.*

6. Elaps Collaris. Perhaps identical with an Elaps said to be found in the Philippines. Form of Elaps Lemniscatus, but with a short, thick, and depressed head; the sixth vertical plate wide, and touching the occipitals. Deep brown; below marked with red spots, of which the angles are continued on the sides; neck ornamented with a collar. S. 229 + 17.

7. Elaps trimaculatus, from India. Of very small size; form extremely delicate; tail everywhere of equal thickness; above of a clear brown, with black dorsal ray, accompanied by other narrow rays on the sides. Head, tip of the tail, and anus black; below yellowish; tail white, speckled with black. S. 241 + 32.

8. Elaps furcatus. 13 rows of scales: body filiform. S. 255 + 22. Head of same diameter as the trunk, and narrow; above of a very dark brown; a dorsal ray, bifurcated on the head, of a fine yellow, which passes into red on the tail; a white ray on the sides. Above a lively green, with dark transverse bands. Size about 15 inches. Inhahits Java, and is also found in the peninsula of Malacca and in Sumatra, where it forms a climatal variety.

9. Elaps bivirgatus. A very beautiful and rare species, scarcely of the thickness of the little finger, with a length of three or four feet; body extremely slender, cylindrical, and all of equal thickness; tail longer than ordinary; head nearly of same diameter with the body; above of violet-blue, passing towards the tail into purple; sides marked with a white ray, undulating and narrow;

head and lower parts scarlet. S. 270 + 49. Inhabits Java and Sumatra, where it forms a variety characterized by a ray down the medial line of the back.

D. *Species of Australasia.*

10. Elaps Müller, from New Guinea and the adjacent islands. Has a body more thick, and a tail short and more conical, than usual; head distinct from the trunk, covered with very long plates, but with a short muzzle. Above brown, or reddish-brown; below sometimes yellow, sometimes green; a ray of yellow, or of a rose colour, passes from the lips to the sides. S. 162 + 28.

11. Elaps coronatus. In size and form like the last, but the muzzle more pointed. S. 138 + 52. Subcaudal plates undivided; six broad labial plates; a single temporal; of a brownish-green colour; top of the head bordered with a black mark.

12. Elaps Psammophis. Resembles, so as to be mistaken for certain Psammophis, and especially for the green variety of Ps. Moniliger of the Cape. Tail more than usually slender. S. 186 + 76. Of an olive green. Below and around the eye yellowish.

BUNGARUS

Forms the second genus of the family of Colubriform Venomous Snakes, and comprehends but two nearly allied species, very recognisable by their back being invested with a row of hexagonal scales, broader than the rest. They have the habit and physiognomy of the Elaps; but their form is more vigorous, and they attain a much larger size. The abdomen is convex, the tail strong, clothed below with undivided scuta. 15 to 17 rows of smooth scales. Body annulated with yellow and black. Head nearly as in the Elaps. Their skeleton has broad transverse processes, flattened into plates. Several solid teeth behind the fangs. Bones of the head very strong. Inhabit India, as well as the Islands of Ceylon and Java.

1. Bungarus annularis.—Body surrounded with entire rings of black and yellow. Tail extremely strong, keeled above, and very thick to the tip. Two streaks

forming an acute angle on the summit of the head. S. 213 + 34. Length 6 feet.

2. BUNGARUS SEMIFASCIATUS.—Size a little less than the preceding. Bones much less strong. Body surrounded with half-rings. Tail more slender and conical. Head more depressed; eyes less large. S. 209 + 46. Tints very subject to variation.

The third and last genus of Colubriform Venomous Serpents is the

NAJA.

They have a more vigorous form than the Elaps or Bungarus; their trunk is not cylindrical, but thickest towards the middle; their tail is more elongated, and always conical; their adbomen wide and convex; their neck possesses, in a greater or less degree, the faculty of dilatation, so as to form a disk; their head is very distinct from the trunk, and often very conical; their eyes are large and lateral; as are the nostrils, which are open; the rostral plate is ordinarily prolonged on the top of the muzzle; the labial plate just before the last, is often of an irregular figure; their scales are almost always lanceolate, and sometimes also carinated. The Najas inhabit hot countries, in the vicinity of the tropics in the ancient world.

1. NAJA TRIPUDIANS.—This is the celebrated snake of which the Indian jugglers make use in the performance of their tricks, and which has obtained the name of *Spectacle Snake*, because its neck is ornamented with a mark having some resemblance to some sorts of that instrument. The neck is very dilatable. It attains a large size. 23 to 31 rows of scales. S. 187 + 47. Brown more or less deep; sometimes uniform; at other times varied by oblique and narrow bands. Tints very subject to variation. Found from Malabar to the Philippines. A climatal variety exists in Sumatra, with dark colours; those of Java are almost black; the tail shorter, and the

mark on the neck is only seen in young individuals. Feeds on frogs.

2. Naja Haje.—Analogous to the preceding, but it has a less extensile neck; a head more conical; a rostral plate salient; labial plates broader, and different tints. S. 208 + 58. 23 rows of scales. Brownish, varied with dark and pale spots. Inhabits Egypt; a climatal variety exists at the Cape: it has a system of colours little constant, varying from brown to yellow, and even to white. It is the *aspis*, properly so called, celebrated in antiquity; and also in our days by the tricks which the sorcerers of Egypt perform with it.

3. Naja Bungarus.—Figure more slender, and size less than the preceding species. Muzzle short, and a little truncated at the tip; eyes large; tail attenuated; and dorsal scales a little larger than the rest. S. 250 + 30, simple, and + 80 divided; or 252 + 23 sim. + 118 div. 19 rows of scales. Above a blue-black, relieved by numerous angular whitish marks. Inhabits the Islands of Java and Sumatra; a very rare species.

4. Naja Bungaroides.—Resembling the last in the colours; but the head more broad and clumsy; the scales of equal size; the tail shorter, and the eyes smaller. S. 214 + 52 simple plates. 21 rows of scales.

5. Naja porphyrica.—Habit of the spectacle snake; head of less size; has 15 rows of scales only; muzzle very obtuse, &c. Above blue-black; sides rosy-purple; below yellow. S. 180 + 50, in part simple. Found on the sandy downs of New Holland.

6. Naja Hæmachates.—A species well characterized by its massive figure; by its head broad at the base, and pointed at the snout; and by its carinated scales, disposed in 19 rows. The neck is a little extensile. S. 137 + 40. Purplish-black, varied with yellow. Inhabits the sandy plains of the Cape of Good Hope.

7. Naja rhombeata.—Of smaller size than the last, of which it has nearly the habit. 19 to 21 rows of scales feebly carinated on the back. Tail extremely vigorous and short. S. 134 + 21. No solid teeth behind the fangs. Pale grey, below paler; a series of lozenge-

shaped spots on the back, a broad angular mark on the head. Observed at the Cape, and on the Gold Coast.

8. NAJA LUBRICA.—Distinguishable by its body encircled by black and red rings. Rostral plate very broad, and advancing far on the top of the muzzle. Size about two feet. 19 to 21 rows of smooth scales. S. 150 + 24. From the Cape.

9. NAJA ELAPS.—Country unknown; of a very large size. Intermediate between the Naja and the Elaps. Form very powerful. Head distinct from the neck, which is not dilatable. Posterior frontal and occipital plates much developed. Labial plate just before the last carried up toward the temporal regions. Eyes very small. S. 183 + 41. 15 rows of smooth lozenge-formed scales, of an ochre-yellow, with brown-marrone centres.

10. NAJA CURTA.—Form extremely clumsy; pupil of the eye a little elongated vertically; tail very short and thick; 19 rows of smooth scales; superciliary plates a little salient; head very wide; cheeks projecting; of an uniform olive-green more pale on the lower parts. The native country New Holland.

The Second Family of *Venomous Serpents* comprehends the *Sea-Snakes*, all of which I have united in the genus

HYDROPHIS.

They are easily distinguished from all other Ophidians by their very broad tail, elevated in a vertical direction in the form of an oar. Their head is small, of the same diameter as the trunk, and covered by plates, as in most serpents, but with this difference, that the nasals, rising to the summit of the muzzle, replace the anterior frontals, which are wanting; the nostrils consequently are entirely vertical, have an orbicular form, and are capable of being shut by means of a valve. The lips have re-entering edges, so that the mouth may be closed hermetically. The eye is small and the pupil orbicular; the fangs are small, and always followed by several solid delicate teeth. The trunk diminishes con-

siderably towards each extremity of the animal, so that the neck is often very slender. The scales are lozenge-shaped, or hexagonal, not imbricated, covered with a thin epidermis, are surmounted by a tubercle; and two are found on those of the mesial row of the abdominal scales, which are hardly larger than the rest. The lung is often prolonged into an air-bladder, which extends to the anus. The prevailing colour is yellow or green. The body is often marked by rings or bands of a dark colour, or with lozenge-shaped spots. The sea-serpents exclusively inhabit the intertropical latitudes of the Indian Seas, or of the great Pacific Ocean. They probably live on fishes, and never go on land. We only know seven species, the last of which is in some sort anomalous, inasmuch as it has lateral nostrils, 5 frontal plates, abdominal scuta of considerable size, and smooth imbricated scales, covered with a hard epidermis.

1. HYDROPHIS SCHISTOSA.—Has a muzzle abruptly conical at the end, and curved like a beak. Rostral plate narrow, prolonged in a point, vertical, of a lanceolate form; nasals trigonal. Eyes quite vertical. 51 Rows of scales. S.300 + 50. Slate-grey, with large brownish bands, more or less effaced. Adults have uniform tints. Inhabits the Gulf of Bengal.

2. HYDROPHIS STRIATA.—Head rounded; muzzle obtuse; a row of little trigonal scales implanted between the labials on the edge of the lower lip. Greenish-yellow, marked above by rhomboidal spots more or less dark, transversely disposed, and sometimes forming bands. Habit less vigorous than the preceding. Length about 6 feet; 29 rows of scales. S. 344 + 50. Seas of India, Sunda, and China.

3. HYDROPHIS NIGROCINCTA.—Very much allied to the last; but it has a sixth labial plate very wide, touching the occipitals, and extending on the region of the temples; its head is more narrow and more rounded; it wants the small supernumerary plates on the lower lip; lastly, its body is surrounded with complete rings of a very dark colour. S. 306 + 49. 29 Rows of scales. Observed in the Gulf of Bengal.

4. Hydrophis gracilis.—Habit of the last, but of less size, and of a very attenuated form, especially towards the neck, which is very slender. Head smaller than in the other species, and very narrow; yellowish, with transverse, lozenge-shaped, black spots. This last colour occupies all the anterior parts, so that the ground colour only appears as narrow bands. Head black, a light spot above the eye. S. 355 + 50. 27 Rows of scales. Gulf of Bengal, and Straits of Sunda.

5. Hydrophis Pelamis.—Has small hexagonal scales, disposed as a pavement; form massive; head much elongated; middle line of the abdomen indicated by a suture formed by the two last rows of scales, of which we reckon 47 in all. S. 350 + 60. Above blackish-brown; below yellow; tail, and sometimes even the whole body of the animal, varied by these two tints. This is the most common species; it is found in all the latitudes inhabited by sea-serpents.

6. Hydrophis Pelamoides.—Form much more short and thick than the last, which it approximates by the structure of the scales; but these organs are larger, and we only find from 25 to 30 rows. Vestiges of abdominal plates, imbedded in the middle suture of the belly. Yellowish, with large dorsal spots lozenge-shaped. S. 136 + 27. Gulf of Bengal, and Seas of China, and the Molucca Islands.

Hydrophis colubrina.—An anomalous species, easily recognised by the smooth imbricated scales, covered with a corneous epidermis; by the lateral nostrils; by the presence of 5 occipital plates; by its abdominal plates, much larger than usual. 23 Rows of scales. S. 220 + 38. Dark green, marked with large black rings, obsolete in the adult. Almost as common as the H. pelamis. Inhabits the same places.

The Third and last Family of *Venomous Serpents* comprehends

The Venomous Serpents properly so called.

They have a physiognomy quite peculiar, with something hideous in their aspect. We might even say, that

their noxious character is expressed in all their parts ; for they have a clumsy and ungainly form ; a very short tail ; a large head, very wide at the base and heart-shaped, all their body is generally rough with lanceolate scales surrounded by a very strong carina ; their muzzle is often truncated, or even turned-up : their frenal region, in several genera, is hollowed out by a wide and deep fossa ; the upper lip is inflated, and descends as in the bull-dog ; the opening of the mouth is much arched ; the eyes are small with a vertical pupil, and buried under a projecting superciliary plate ; their fangs are extremely large, and alone occupy the maxillary bone, which is reduced to a small size, while the external pterygoids form a lever in the shape of a stylet. This structure determines the nature of their attacks, which are quite peculiar, inasmuch as they remain quite inactive, until the animals on which they feed come within their reach ; when they throw themselves on them, strike them at a single blow with the fatal wound, which, placing their prey beyond the chance of escape, makes it fall into their power. The Venomous Serpents, properly so called, are found in the five great divisions of the world. Sometimes they inhabit woods, sometimes plains. We are acquainted with three genera. The two first have nasal fossæ.

TRIGONOCEPHALUS.

This genus has a tail terminated by a horny and conical tip. They inhabit wooded regions in both worlds ; but they have not been found in Europe nor in Africa, where they are replaced by the Vipers. We can distinguish two divisions in this genus, founded on the nature of the teguments of the head.

A. Species with the head covered by *scales*.—They are especially peculiar to the torrid zone.

1. TRIGONOCEPHALUS JARARACA.—Form a little more slender than usual ; head longer, covered with scales, a little larger towards the point of the muzzle, of which the

borders are garnished with plates; 9 labial plates. S. 188 + 53. 27 rows of scales, lanceolate, and strongly carinated. Olive-brown, usually varied by broad bands or lozenge-shaped spots. Inhabits the forests of Brazil.

2. TRIGONOCEPHALUS ATROX.—Very analogous to the preceding, which it appears to represent in Guyana; but it has 8 labial plates, 4 pairs of geneials, a more conical muzzle, scales less narrow, and less strongly carinated; it has clear tints, verging to greyish purple. S. 194 + 64.

3. TRIGONOCEPHALUS LANCEOLATUS.—Replaces the two preceding in the smaller Antilles, and is much allied to them, but it has more numerous abdominal plates; colours verging to green, or to yellow; has two pairs of very small geneial plates, and has 31 rows of still smaller scales. S. 255 + 64.

4. TRIGONOCEPHALUS BILINEATUS.—Very recognisable by its thin tail, susceptible of being coiled inwards, by its very compressed, slender trunk, and by its narrow belly, by its small scales, and, finally, by its beautiful green colour, passing to reddish brown on the tail, and relieved by a ray of lemon-yellow near the abdomen. Above of a whitish-yellow. S. 280 + 78. 29 rows of scales. Very rare, in Brazil and in Cayenne.

5. TRIGONOCEPHALUS NIGROMARGINATUS.—A species of small size, well characterized by its lozenge scales, smooth, and disposed in 19 rows, larger on the summit of the head, by 2 broad plates at the tip of the muzzle, by divided superciliary plates, &c. S. 137 + 56. Above dark green, varied with black spots. Comes from Ceylon.

6. TRIGONOCEPHALUS WAGLERI.—Head very wide and thick; muzzle angular at the sides and obliquely truncated downwards; 5 pairs of very squat geneials; 25 rows of scales provided with strong keels, prolonged to a point under the throat. Above deep green, with transverse yellow bands. S. 140 + 48. Inhabits the Island of Sumatra.

7. TRIGONOCEPHALUS VIRIDIS.—Middle sized; above uniform green; below yellow; two large plates at the tip of the muzzle, which descends almost perpendicularly;

21 rows of lanceolate, carinated scales. S. 164+64. From India, and also from the Isles of Sumatra, Celebes, and Timor.

8. TRIGONOCEPHALUS PUNICEUS.—Very distinguishable by its eye protected above by a row of small scales, rising to a point. Head very broad, heart-shaped, and flat on the summit; muzzle angular and excavated at the sides, tip rounded and obliquely truncated. S. 162+54. Reddish-brown, dashed and varied with yellow, with purple, or with grey; tail very dark. Country, the Island of Java.

B. Species which have *plates* on the top of the head.—

9. TRIGONOCEPHALUS RHODOSTOMA.—A very beautiful species. Form very vigorous; head heart-shaped, furnished on the summit with 9 plates more than usually developed; a very conical muzzle, with a moveable prominent tip; scales smooth, lozenge-shaped, and largest on the middle line of the back, which is keeled; tail short and pointed. S. 147+55. Reddish brown, more bright on the back, the sides of which are ornamented with broad, dark, triangular spots; summit of the head bordered with a wide reddish ray; a black streak behind the eye. Inhabits Java.

10. TRIGONOCEPHALUS HYPNALE.—From Ceylon and the Philippines. Size small; muzzle prolonged into a salient turned-up tip; above covered with SCALES, to which succeed the vertical, the superciliary, and the occipital *plates;* 19 rows of carinated scales. S. 142+40.. Colours of the body nearly as in the last.

11. TRIGONOCEPHALUS HALYS.—Form more slender than usual; head elongated, covered with 9 plates, of which the anterior frontals are very compact; muzzle short and rounded; 27 rows of lanceolate, carinated scales. S. 165 +37. Above yellowish grey, with 5 rows of brownish spots. Observed in Tartary.

12. TRIGONOCEHALUS BLOMHOFFII.—Plates on the head nearly as in the last, but the form of the animal is more clumsy, and the head larger; 25 rows of strongly carinated scales. S. 139+51. Above olive-brown, with two

rows of dark oval spots; a broad black streak behind the eye. Japan.

13. Trigonocephalus Cenchris.—From North America. Very distinguishable by its small occipital plates (which are sometimes entirely wanting), and by the scales of the occiput, which are roughened into tubercles instead of keels; form massive. S. 130 + 43. Body ornamented above with large bands of coppery brown, which permit the ground colour to appear as large lozenge-formed spots, of a greyish colour.

CROTALUS.

The second genus of the *True Venomous* Serpents. They are peculiar to the New World, and prefer inhabiting dry uncultivated places; we may say, that they take the place of the Vipers in both Americas. They have the nasal fosse like the Trigonocephalus; but their form is more robust, their head thicker, their tail armed at its extremity either with a sounding instrument called a *rattle*, or with a hard scale prolonged into a long and sharp point. We only know four species of this genus, some of which arrive at a size superior to any other venomous snake.

1. Crotalus horridus.—The great Crotalus of South America. It has a muzzle covered with 3 or 4 pairs of plates; 29 rows of lozenge-formed scales, surmounted with a sharp carina. S. 145 + 25. Above of a yellowish brown, variegated on the back by a range of broad lozenge-shaped spots.

2. Crotalus Durissus.—Replaces the last in North America, and is found in Mexico. Very much allied to the C. horridus; but it has only 2 pairs of plates on its muzzle; the carina on the scales is less developed, the eyes are smaller, the colours darker, the spots often form bands, and the tail is black. S. 170 + 22.

3. Crotalus miliarius.—A small species of North America. Very recognisable by its head, covered on the top with 9 well developed plates; 23 rows of scales. S. 131 + 26. Eye large; colour a reddish grey, varied by three series of darker spots.

4. Crotalus mutus.—Remarkable by its tail armed at the tip, in place of the *rattle*, with a hard and sharp point. Head covered with scales; back carinated; scales surmounted with a keel in the form of a tubercle. Arrives to the length of 10 feet; it is the largest of all venomous serpents. It forms the passage to the Trigonocephalus; but its physiognomy is wholly that of a Crotalus. S. 227 + 49. From South America.

VIPERA.

The third genus comprehends all the *True Venomous Snakes* that want the nasal fosse. They usually have the head and body covered with lanceolate, carinated scales. Their forms are often very heavy, and their tints of a grey or tawny brown. They inhabit deserts, or uncultivated places in the ancient world.

1. Vipera Arietans.—Of a strong make, and a heavy and hideous form; head large, very flat, and with a muzzle very broad and obtuse; nostrils vertical, extremely spacious; head and body covered with lanceolate scales raised into a strong carina. S. 134 + 27. Above yellowish, with three rows of spots, often oscillated, 2 pairs of which are on the occiput. From the Cape, and the Gold Coast. A local variety, with brighter tints, inhabits Kordofan.

2. Vipera Atropos.—From the Cape. Size less, and form less powerful than the V. arietans; head smaller; nostrils less wide, and more lateral; of a very dark brown, relieved on the upper parts by 4 rows of ocellated spots. S. 138 + 23.

3. Vipera cornuta. — Size small; form extremely short; eye protected above by a range of scales prolonged into a point; nostrils lateral. Grey-brown, varied with dark-coloured spots, a central row of which runs down the back. Pl. 124 + 22. From the Cape; very rare.

4. Vipera Echis.—Eye surrounded with a row of small scales; nostrils narrow, near the tip of the snout, which is furnished with 2 plates on the upper part; tail short, furnished with simple scuta. S. 156 + 30. From India;

also found in Northern Africa. Greyish or yellowish brown, has rays and ocellated spots on the upper parts.

5. Vipera Cerastes.—Conspicuous by its very broad heart-shaped head; by its short, obtuse, and rounded muzzle; by the nostrils very narrow, vertical, and placed at the tip of the snout; by its scales, surmounted by a keel, in the form of a tubercle; by its pale tints, greyish or earth-coloured; and, lastly, by the development of the superciliary scales, one of which is often converted into a point of considerable length. S. 134 + 29. Inhabits the deserts of Northern Africa.

6. Vipera elegans.—Form more than usually slender; eye protected by a superciliary plate; nostrils very open, lateral; muzzle narrow, drawn out, and angular at the sides; of large size. S. 168 + 52. Comes from India and Ceylon. Bright yellowish-brown, with 3 rows of oval spots, bordered with black, and white on the lower parts.

7. Vipera Berus.—The Common Viper of the north and centre of Europe, is also disseminated over a great part of Asia. Middle size; top of head invested with plates, among which we distinguish a vertical, superciliaries and two occipitals; muzzle rounded, and angular at the sides; nostrils wholly lateral. S. 145 + 35. Varies from brown and grey, to black and red; a broad zig-zag ray along the back. The males have the brightest tints.

8. Vipera Aspis.—Takes the place of the last, which it nearly approaches, in the south-east of Europe, and is also found in Sicily. Form rather more slender; head larger, covered above with scales of an irregular form; muzzle a little turned up; body with several rows of spots. Varies like the last. S. 152 + 42.

9. Vipera Ammodytes.—Nearly allied to the two last by habit and physiognomy; but it has a thicker shape, a muzzle prolonged in a point directed upwards, the summit of the head very irregularly covered with scales and small plates. S. 150 + 34. System of colours nearly as in the Common Viper, but it often has the tail reddish. Inhabits the south-east of Europe, from Sicily and Dalmatia to Greece.

10. VIPERA ACANTOPHIS.—An anomalous species of New Holland; has a massive form; a slender tail terminated by a hard point; has the top of the head covered by 9 plates; has superciliary plates, usually elevated and inclined towards the summit of the head. It has 21 rows of carinated scales. S. 115 + 40. Brownish-grey, variegated and dashed with black.

ESSAY

ON THE

GEOGRAPHICAL DISTRIBUTION

OF

OPHIDIANS.

In proposing to give, in the following pages, a sketch of the distribution of Serpents on the surface of the globe, I consider it necessary to enter into numerous details, with which I might have dispensed, if this part of the science had been previously cultivated, or if any one had already laid the foundations. I have occupied myself with considerable zeal in this study, which merits an especial attention—not merely because it regards the animals of which I treat in my work, but because it ought to lead, in my opinion, to results much more satisfactory than the study of the geographical distribution of the animals in the other classes of the Animal Kingdom, or even of Vegetables. The reasons in favour of this proposition are obvious. A thousand different agents contribute to disperse different species of plants over the surface of the globe: the seeds of plants are carried by the winds and the waves; man perpetually transplants a great number

of vegetables from one country to another; and, by cultivation, he has so changed the face of nature which surrounds him, that the surface of the earth has, in some measure, lost its primeval features, and vegetation, at least, has experienced great modifications. Most animals have the means of spreading themselves on the surface of the globe. The element which saw their birth, offers no limits to marine animals. Certain mammals extend, constantly, the sphere of their habitation, and spread themselves by degrees over many parts of the world. Other species accompany man in his peregrinations, even beyond seas, dispersing themselves in diverse regions, either when transplanted by man himself, or when, recovering their liberty, they form, as it were, colonies far from their mother country, where it sometimes happens that their race is totally destroyed, or that all the individuals have passed to the domestic state. Birds enjoy more than other animals the faculty of moving from one place to another; the element in which they move nowhere presenting obstacles to them, a large part of the inhabitants of the air lead a real nomade life, and often establish themselves in places where they were never seen before; a great number disperse themselves, in their periodic migrations, into countries the most distant, and become true cosmopolites; the same species inhabiting, at the same time, all parts of the earth. It is far otherwise with Reptiles. None of the circumstances we have mentioned can be rigorously applied to these animals. Deprived, for the most part, of the means of performing distant journies, they are, in some measure, attached to the soil which gave them birth; and we do not recognise in them any instinct to flee the natal soil, when certain circumstances would seem to demand it. The cold which deprives them of the means of subsistence, causes them at the same time to fall into a profound lethargy; and Nature, in this simple manner, watches over their preservation during the winter. Man entertains an aversion for these animals, some of which are noxious, it is true, but many of them are innocuous, and even useful; he repels them all, and seeks not to tame them; still less is he inclined to transplant them,

without a motive, from one place to another. It is true that there exist certain reptiles which form exceptions to what we have stated. Several species of Tortoises are dispersed over various parts of the globe ;* the Scincks and the Geckos are perhaps carried in ships from one region to another ; the Sea Tortoises undertake voyages at certain periods of the year, and are known upon coasts which their race never inhabit; Crocodiles† and Boas‡ have been sometimes carried by currents far from their native regions ; but these examples are very few in comparison of what we observe in mammals and in birds, and merely form exceptions, as regards serpents,§ to what we shall state in the following pages. It is evident, after what we have said, that the geographic distribution of Ophidians should possess an interest altogether peculiar in this, that it presents the most certain means of knowing the relations which exist between the animals and the places they inhabit. This study will contribute to clear up the grand and important questions on the *Foci* of creation, and the immutability of species. In reposing on the facts which it presents to us, we shall more readily arrive at an idea of the face of Nature, such as she was in the primeval state, before the art of man had transformed the surface of the earth, before he had driven from their habitations a great number of animals, either destroying them totally, or reducing them to a state of domesticity, and changing or modifying their nature, by altering that of the places they inhabit. We cannot at all apply this to reptiles in general, and still

* The Indian Tortoise, probably originally from Madagascar and the neighbouring isles, has been acclimated in the Galapagos Isles, in California, and in several other points on the western coasts of South America.

† LESSON (*Voy. de la Coquille Zoologie*, ii. 2, chap. 9, p. 10) quotes two facts, drawn from MARINER and KOTZEBUE, which create the suspicion of the presence of a large Crocodile in the isles of Pelew and Fidschi, where those animals do not ordinarily dwell.

‡ GUILDING (*Zoolog. Journ.*, iii. p. 403) relates a fact of this nature : a Boa, entwined around a tree, having been driven from the adjacent coasts of America, and thrown on the shores of St Vincent.

§ The Hydrophis, for example, have their native region always circumscribed within the same limits ; although all these Ophidians inhabit the sea.

less to serpents. The places of their habitation are forests, marshes, or even deserts, and these places have never perceived the influence of cultivation. Not multiplying, except rarely, so as to incommode man, and seeking to withdraw themselves from pursuit, by retiring to the uncultivated places which serve for their retreat, the war which is made on them is usually only directed against individuals; hence, the number of species, as well as of individuals, ought to remain almost at the point fixed by the general law of Nature from the beginning; and this is one of the facts which it is essential to establish in physical geography. Now, supposing that the animals of which we speak live still in the same places originally assigned to them; that they still live in the same climate, and under the same conditions, it is evident that they cannot have been subject to any change in the course of ages: they present, then, more than any other living creatures, bases to ascertain with precision what should be understood by *species*, by constant varieties, or by varieties produced by local causes, or by climate. The remarks which I throw out will suffice to shew how important is the study of the geographical distribution of reptiles, especially of Ophidians, and the influence which this study ought to exercise on that of the geographical distribution of animals in general, on zoology, on geology, and on physical geography.

The geographic distribution of serpents is subject to nearly the same laws as that of other reptiles; that is to say, their number augments considerably towards the torrid zone, while they are but rare in cold regions. It even appears that serpents do not advance as far northwards as lizards and batrachians, which are probably among the number of the most widely distributed reptiles.* The geographic distribution of serpents, viewed in relation to different parts of the world,† presents some interesting

* [The Translator has seen both frogs and toads in the Orkney Islands, but he never heard an instance of a serpent or a lizard being found in that group of islands, nor yet in Zetland.]

† I have given above, p. 92, some observations on the nature of the places which serpents inhabit; but as we do not possess any exact notices

matters for observation. One of the most curious is, without doubt, the total absence of serpents in the numerous isles of the Pacific Ocean,*—a phenomenon the more remarkable, that the islands forming the Great Indian Archipelago appertain to those regions of the earth most abounding in serpents. Another point no less interesting to know is, that the serpents, and all the reptiles of the New World, constantly belong to species different from those of the ancient world,†—a proved and very curious fact; because a great many birds, and several mammals, of North America, are precisely the same as those of Europe, as also of a great part of Asia; and because several of our reptiles are found all over temperate Asia, even in Japan, often without presenting the slightest difference. South America, in general, produces different species from North America, although several of them are perfectly identical in those two great regions. Some species of the first region also inhabit the Antilles, and are even found in the southern countries of the United States, where they sometimes form climatal varieties; other species, common in North America, are found in Mexico, and are often met with also in the Antilles. America, in general, especially in its equatorial regions, is almost as rich in serpents as Malayan Asia. It is not thus with New Holland, which seems to be inhabited by only a small number of Ophidians; forming, perhaps with the exception of some few in the northern parts, species peculiar to that vast island. The serpents of Japan pertain, without exception, to peculiar species which have not yet been observed in any other spot on the globe. The numerous Isles of the Archipelago of Malayan Asia often support species en-

on the *perpendicular* distribution, that is to say, with regard to the heights at which they are found, I here omit to speak of it.

* Lesson (*Voyage Zool.*, ii. 2, p. 9) relates some observations which tend to confirm the presence of serpents in the isles of Botouma at Oualan; but these observations want confirmation. The Mariannes, however, support several snakes; and Dampier, *Voy.* i. p. 113, speaks of green serpents in the Galapagos Isles. I need not refute the hypothesis advanced by Quoy and Gaimard (*Voy. de l'Uranie Part. Zoolog.*, p. 111), that these animals do not inhabit those isles and similar places, because of their volcanic nature.

† It may be conceived that I except from this number Sea Tortoises.

tirely similar, and often also absolutely identical with those of Malacca, of Bengal, of India, and even of Ceylon. Sometimes, however, the species in those different places present differences more or less marked, and give rise to the establishment of local varieties. To judge from the small number of its productions known to us, the great Island of Madagascar would appear to have a Fauna of its own. Africa is not rich in Ophidians. The southern part of that vast peninsula produces species different from those of Europe, or of other parts of the earth; and those same species are often found dispersed over intertropical Africa, and even extending to the northern parts of that continent; but besides a few peculiar species, those last countries produce several others, which inhabit, at the same time, almost all the countries bordering on the Mediterranean, even Syria, and consequently a great part of Europe. Most of the serpents of this last continent, finally, are spread over a great part of temperate Asia,—a region which appears to produce but a small number of peculiar species.

The geographic distribution of genera or of families, viewed as representing the different principal forms, is not a less curious study, than that of the species. We see at once that the venomous snakes are distributed, perhaps, with the exception of some islands, in every country inhabited by snakes in general. These dangerous reptiles appear not to dread cold, for they are found often as far to the north as the innocuous species. But their number is much more limited than that of the latter: for if we reckon the number of all known Ophidians at 263, 57 of these are venomous,* which makes the proportion of the venomous to the innocuous as 1 to 5. We shall see, however, afterwards, that this proportion is not the same in all countries of the globe, and that the number of venomous serpents, at least that of individuals, appears to be more considerable in naked and steril countries,

* We should also remark, that seven species of venomous snakes exclusively inhabit the ocean, where non-venomous serpents are never seen.

where that of innocuous snakes seems to diminish. Africa and New Holland furnish examples of this : in the former continent the species of known innocuous serpents are in the ratio of two or three to one, whilst it is almost the reverse in New Holland, where, of the ten known species of snakes, there are seven venomous. As to the number of individuals, it is much more limited in the venomous serpents, these last, with the exception of the Sea-Snakes, almost always living solitary, and not multiplying ever to the point of becoming abundant, except by a concurrence of very favourable circumstances ; as has happened in the sugar colonies of France, in regard to the Trigonocephalus lanceolatus, or in Dalmatia, in regard to the Vipera ammodytes. Venomous serpents, then, belong generally to the rare class, and they are perhaps much more rare than is usually conceived ; either because the number of individuals is often very circumscribed, or because, thanks to their habits, they more readily escape the observation of mankind.* Excepting the anomalous species which compose the family of Tortrix, there exists not one species of serpent, which is at the same time spread over all parts of the globe inhabited by reptiles ; and this curious fact will serve to demonstrate how intimate is the relation subsisting between the organization of beings and the nature of the places they inhabit. The True Colubri, for example, which are destined to inhabit countries woody or marshy, but covered with an abundant vegetation, have not yet been found in New Holland, and are so rare in Southern Africa, that only a single species is known, which departs, moreover, in several points in its structure, from other Colubri, inasmuch as it approaches to those serpents that prefer to inhabit desert or sandy countries. We may apply almost the same observations to the genus Coronella—serpents which inhabit marshy

* The numerous packages which are continually addressed to the museums of different countries, might furnish a scale of comparison, to ascertain the relative number of individuals of the two great tribes of serpents : the researches which I have made on this head, have proved to me that, at an average, the number of individual venomous serpents is to that of individual innocuous serpents as one to twenty.

plains or close brakes, of which no species exists in New Holland, while those of Southern Africa depart from the typical species. The TREE-SERPENTS are more especially peculiar to equatorial countries ; but, as they inhabit vast forests, or well wooded countries, they are not found in countries where those necessary conditions of their existence are not met with. This is probably the reason why these serpents have not been observed in the greatest part of New Holland, and that Southern Africa supports but a single species of this family, anomalous besides, and approaching to the genus Coluber. The three genera which compose this family of tree-serpents, are found in both worlds ; but it is remarkable, that the DIPSAS of America never arrives at that great size which is observed in most of the Indian species, and that the DRYIOPHIS of both Americas form a true geographical division in this, that they have the dentary system and the muzzle less developed, and that the pupil of the eye is orbicular. The fresh-water serpents which are comprehended in the two genera, TROPIDONOTUS and HOMALOPSIS, are found in abundance in countries rich in lakes, or watered by numerous rivers. Hence it is that these animals are common in Asia, in America, and even in Europe, that they are probably not met with at all in New Holland, and that they are scarce in Africa ; for there exists but a single species of Tropidonotus in the southern parts of that vast continent, and even this species presents an organization wholly anomalous. The Homalopsis even, which are preeminently fresh-water snakes, and essentially aquatic, and which belong to warm countries, have not been observed in New Holland, nor in Africa, whilst they abound in both Americas ; they even replace, in South America, the Tropidonotus, which has not yet been discovered in that vast peninsula. The geographic distribution of the genus BOA presents us with several facts worthy of notice. They are also serpents peculiar to hot climates. The true Boas are only found in South America; they are replaced in the old world by PYTHONS ; but we find in the Indies several serpents very analogous to the Boa, but of very small size, and of which there does not exist in the whole west-

ern hemisphere but a single representative in the island of Cuba. The Acrochordus is wholly peculiar to the East Indies. Among venomous serpents, it is only the VIPERS, and perhaps some of the genus CROTALUS, that advance to the north, as far as temperate or cold climates. The other genera appear most particularly destined to inhabit inter-tropical countries. Of the colubriform venomous snakes, the genus ELAPS is the only one which is found in the two worlds ; and yet the Elaps of America forms a small geographic group, distinguished by the system of colouring, and by some petty details in form; those of India are longitudinally streaked or rayed, instead of being annulated with red and black ; those of New Holland may be considered as forming anomalous species. The BUNGARI are peculiar to the East Indies, where are also found the NAJAS, though the greater number of the latter appear to prefer to live in arid or sandy plains, which explains why they predominate in Africa and New Holland. We are yet unable to explain the phenomenon that SEA SERPENTS are exclusively found in the Indian seas, from Malabar to the Great Pacific Ocean. Lastly, it remains to offer some curious observations on the distribution of VENOMOUS SERPENTS PROPERLY SO CALLED. Of the genera of which this family is composed, one, the VIPERA, is peculiar to the ancient world, whilst the CROTALUS is only found in the two Americas, where it replaces the former ; but the TRIGONOCEPHALUS is found in either world. These last reptiles, which inhabit wooded countries and vast forests, have been observed, for that reason, neither in Africa nor in New Holland, where they are replaced by the Viper ; but it must be remarked, that the Viper of New Holland forms an anomalous species, while those which inhabit Europe differ equally from the typical species, and approach the Trigonocephalus. We may establish in this genus two divisions, one of which comprehends the species with a head covered by scales, that more especially inhabits tropical countries, while those which have the head defended by *plates* are found in temperate regions.

Having given, in the preceding pages, a general sketch

of the Geographical Distribution of Ophidians, we now propose to treat more particularly of each region of the earth known to be inhabited by these animals.

In commencing with EUROPE, we perceive that this part of the globe supports neither Calamars, nor Heterodons, nor Lycodons; that the true Tree-Snakes are not found in it, nor even the Herpetodryas; that it furnishes neither the Homalopsis nor the Boa; that the Colubriform Venomous Serpents and Sea-Serpents are never there met with; lastly, that the true Venomous Snakes have no other representatives than several species of the genus Vipera. There is not one species peculiar to the central, or northern parts of Europe,—almost all being equally found in the South of Europe, a region which produces several species that also inhabit the adjacent parts of Africa or of Asia. We can, however, assign limits to some of the species, which affords room for some curious speculations. The common Viper, *Vipera berus*, for example, inhabits all the central part of Europe, and appears also distributed in temperate parts of Asia, even to the Lake of Baikal; it is also found in England* and Sweden; but towards the West, it is not found beyond the Seine, while the Alps appear to form the boundary of this species† on the South. In the southern and western parts of Europe it is replaced by the Vipera Aspis, the Aspic, which is found from Trieste throughout Italy and Sicily, in Switzerland, and in the whole of France, from the Seine to the Pyrenees, and probably also in the Iberian peninsula.‡ The southern parts of the east of Europe produce, on the other hand, a third species of this genus, the *Vipera ammodytes*, which is found from Styria to the south of Hungary, in Greece, in Dalmatia,

* [It is very common in Scotland. The Translator has specimens killed in Dumfriesshire, in Peebles-shire, and in Ross-shire.]

† It is said that it has been also met with in the valley of the Po, near Florence, but in very small number.

‡ [The Translator saw, in the apothecary shops in Madrid, and other cities in Spain, many specimens of the Vipera Aspis, of a yellowish olive-brown colour, with detached spots along the back, a slender body, and large head. He noted it at the time as "a variety of the common Viper:" none like our Vipera berus were observed by him in Spain.]

in Sicily, and probably also in Calabria. This distribution of species would appear to be modified by the nature of the soil which they inhabit: the first, in general, preferring heaths, marshy and wooded places; the second a dry and arid soil; the third, rocky regions. We have not observed varieties of these serpents produced either by locality or climate; but it is not so with several other snakes of Europe, which are spread over almost the whole extent of that continent. We may cite, as examples, the Coronella lævis and the Tropidonotus natrix, and T. viperinus. These species, the two former of which inhabit almost all northern and central Europe, and the last as far as the 50° N. Lat., are equally found in the south of Europe, where they often form, besides a great number of accidental, several local varieties. In Spain, for instance, the Tropidonotus viperinus has the back longitudinally rayed; the same occurs in the Tropidonotus natrix of the Island of Sardinia; and specimens of this snake killed in Sicily present also other slight differences; the Coronella lævis also forms* in Italy a local or climatal variety, and a variety with more clear tints, which is found in the environs of Marseilles, and which replaces our Coronella in the south of Europe. The Coluber Æsculapii, which inhabits the south of Germany, is found in Dalmatia, in Italy, and as far as Provence. The Coluber viridiflavus has been found in all the south of Europe and of Greece, in Hungary, in Dalmatia, in Italy, in Sicily, in Sardinia, and even in France and Switzerland. The Coluber hippocrepis inhabits Spain and Sardinia, while the Coluber leopardinus is found in Sicily, Dalmatia, and Greece; but as far as I know, neither of the two species has been seen in Italy. The Psammophis lacertina, common in Dalmatia, in Spain, and in other countries on the shores of the Mediterranean, has not been found either in Italy, or in any of the adjacent islands. The southern countries of Europe produce several other species of serpents, which

* I can confidently state that the character of the pretended Coluber Riccioli, drawn from the undivided nasal plate, is purely accidental; as one may be convinced by examining the series of specimens of that Coronella preserved in our museum.

do not seem to inhabit a great extent of territory; such is the Xenodon Michaelis of Spain, the Psammophis Dahlii of Dalmatia, which is also found in Greece, and which approaches, by its slender form, to the tree-snakes; the Dipsas fallax of the same countries, which should be considered as an anomalous species of the genus; lastly, the Tortrix eryx, which only occurs in Greece, and of which the deserts of Africa and of Asia are the true native regions. In comparing the observations which the other animals of Europe furnish, with those which we have announced on the reptiles of this part of the world, we may deduce some analogies. We see that the animals of the northern regions are often replaced in the centre of Europe by others which form local varieties, or sometimes even races; and the comparison of the animals of central Europe, with those of its southern regions, often presents similar results. We may cite numerous facts to support this opinion; and I shall state a few. Our Raven is replaced in the Feroe Isles, by a variety with a mixture of black and white feathers. The Hooded Crow, and the Black Crow, are two races of the same genus which represent each other mutually; the first belongs to the northern parts of Europe. It is well known that the same thing holds with respect to the Sturnus volgaris, and S. unicolor; the last of which, more especially, inhabits the south of Europe. Our Emberiza schoeniculus is replaced, in Dalmatia and in Italy, by the Emberiza palustris, which has ordinarily a much stronger bill; but its existence as a distinct species cannot be proved, because we often find individuals exactly intermediate between the two races.* Everybody knows the local races which our Sparrow produces among the Alps

* We must not imagine that each of these races is, in relation to the place of habitation, perfectly separated from the race which it replaces; very often they mingle in their migrations, or live in the same places, disappearing insensibly as their representatives increase; it happens, also, that individuals of the two races propagate together, as happens with the Corvus cornix and C. corone—a fact which I have ascertained by numerous observations, made in the neighbourhood of Dresden. Consult, on these questions, the excellent works of M. Gloger of Breslau.

and Pyrenees, or in Southern Africa. The geographic distribution furnishes numerous facts for illustrating our position. It is well known that there exist, in different parts of Europe, and of the north in general, Lynxes differing more or less from each other, which seem distinct races, produced by the influence of climate on the fur.* The Fox of the north† is of a stronger make, and has a thicker fur, than that of the south of Europe: in Italy it remains very small, and has a black belly (Canis melanogaster, Bon.) The Stoat (Mustela erminea) of Sardinia and of Sicily,‡ differs a little in tint from individuals found in the rest of Europe. The Rat (Mus decumanus) is replaced in the south of Italy by a race somewhat different: it is the Mus tectorum of the PRINCE of MUSIGNANO. Another very curious animal, which in many places represents our Mole, is the Blind Mole (Talpa Typhlops). It is known that the Chamois of the Alps presents slight differences from that of the Pyrenees; it would be interesting to know, if it also holds of the Bouquetins (Capra ibex) of those two chains of mountains. Reptiles, in like manner, present many examples of these local differences: our aquatic Salamanders frequently exhibit in the south more vivid colours than in the west of Europe; while the common Toads of Italy have more uniform colours than usual, and the body is rough with spines. Slight differences exist between the Greek Tortoise of Italy, of Greece, of Syria, and of the north of Africa. The common Frog often has, in Sardinia, the body covered with large obsolete spots: in

* The same thing is remarked in the Tigers of the north of Asia, compared to those of Bengal, or even of Sumatra and Java; similar phenomena are remarked in certain plants with smooth leaves, which, carried into a cold climate, become clothed with hairs, to defend them from the cold.

† Japan, situated under the same parallel as the south of Europe, produces Foxes of a strong make, and of a beautiful fur, but much resembling our European Fox; of which a fine variety is also known in the north of America (Canis argentatus, GEOFF).

‡ Species have been created on a pretended difference in the number of the grinders—an observation which it is scarcely necessary to refute.

Greece our Slow-worm has the body sprinkled with dark points, and is then the Anguis punctatissima of Bibron. Finally, I could cite a great number of analogous facts drawn from the class of Insects; but this would lead me into an abyss, through which I might never be able to see my way.

The study of the geographic distribution of animals in Africa offers a number of facts extremely curious, and of the highest importance to physical geography, and even to descriptive zoology. There is not, perhaps, a country on the earth which furnishes such striking proofs of the relations which subsist between animals and the places they inhabit. In studying, then, the constitution of that great continent, we may, in some degree, divine the nature of its productions. The predominant feature of Africa is the presence of vast arid plains; whether they form true deserts of sand, or present them under the aspect of terraced table lands, elevated sometimes to a height of several thousand feet above the level of the sea, and decked with vegetation only during a short period of the year. A soil of that nature, perpetually scorched by rays of a vertical sun, is ill adapted to furnish vapour, which, condensing in the atmosphere, may again fall in rain, snow, or hail, to fertilize the earth. These conditions, and the absence of lofty mountains in that part of Africa, modify the nature of its fresh waters, or of its streams in general. Hence, the rivers of that continent are in all respects inferior to those of other continents; they but rarely form the grand accumulations of fresh water, which are so favourable to the formation of vapours; their banks are not usually covered by that luxuriant vegetation which attracts such multitudes of all classes of animals; those rivers, swollen in the rainy season, during a short period, by the sudden increase of their waters, retire after this period within their beds, where they are sometimes so much reduced as scarcely to merit the name of a stream or a river. It results from what we have said, that Africa, being neither watered by large rivers, nor covered with an abundant vegetation, being denuded of great forests, ought to support but a small number of those animals that inhabit fresh

waters or woods ; while the animals intended especially to inhabit plains should be there found in abundance; and these views are confirmed by experience. We see in Africa, instead of deer, many species of antelopes, wandering in vast herds in open regions. Squirrels are there found in small numbers, and the species which are there met with generally depart from the true squirrels by their terrestrial habits. The great number of the Rodentia that people that continent almost all belong to terrestrial species ; many of them even live in open countries, and, being unprovided with means of defence, Nature has attended to their preservation, by developing their organs of locomotion, so as to make them true leapers ; and it is in this manner that these animals possess the faculty of escaping, by a sudden flight from the pursuit of their enemies. We observe the same fact in certain mammifera of the insectivorous order.—The Reptiles of that part of the world afford still more striking examples of what we assert. Africa alone supports a greater number of land tortoises than all other parts of the world put together ; but the fresh-water tortoises are in such small numbers, that we only know a single species of Emys, and possibly one or two species of the genus Trionyx. Another observation worthy of notice, is the small number of Batrachians proper to this continent. There exist but a few toads, some species of Bombinator, as many of the frog, and one or two species of tree-frogs (Hyla.) The same fact presents itself as regards tree and aquatic serpents. The Dryiophis and the Homalopsis are entirely wanting ; and there exists only two species of the genus Dipsas, two of the Dendrophis, and one or two of the Tropidonotus. The most striking example, however, is the almost total absence of fish in the fresh waters of Southern Africa.—But the general observations which we have made on the physical constitution of Africa cannot be applied to every country of that part of the world. At the point of greatest breadth in that continent, the great plateau which occupies all the southern part, descends rapidly towards the desert plains of the north, and is prolonged, on one side, beyond the Quorra, in Upper Soudan ; whilst the terraces of that same

plateau surround, on the other side, the Alps of Abyssinia. It is from those lofty mountains, or from the northern slope of the grand plateau of Africa in general, that the largest rivers of that continent arise; it is at the foot of these mountains or terraces, where those wooded marshes called *kulla* are formed, which surround, in the centre of Africa, that grand basin of fresh waters which may be compared to an interior sea. Presenting a more fertile soil, the regions now under consideration are covered with a more abundant vegetation than the rest of Africa; and there the soil, and the rivers by which it is fertilized support a greater variety of animals, often belonging to very different genera. This diversity in the physical constitution of different regions of Africa must necessarily exercise a considerable influence on the geographical distribution of the animals which dwell therein. The animals which are more especially intended to inhabit the elevated plains of the southern part of that continent, are often found on every point of the grand plateau which combines the conditions necessary to their existence. This is the reason why many of the animals of the Cape of Good Hope have been observed on the coast of Guinea, and even as far as Abyssinia. Sometimes these animals are found to be exactly the same, in regions very distant from each other; at other times they present in one or other situation, minute differences, which are often nothing more than slight variations in the shades and vivacity of their tints, or perhaps only in their distribution; sometimes it happens that these animals constantly differ, and in such an essential a manner, as to justify the elevation of those different representatives to the rank of species. On the other hand, we observe a certain identity between many of the animals of Abyssinia and of the Senegambia: those two regions very often support the same species, the representatives of the same animal forming sometimes local varieties, at other times distinct species. The productions of those countries shew sometimes an affinity with those of intertropical Asia; and we there even find several species of animals which are also found in some parts of Asia, and even in Malayan Asia. This identity is more remarkable still between the

animals which inhabit the countries situated to the north of the grand plateau of Africa, and those which inhabit Western Asia as far as Hindustan. It is true, that in both continents these animals choose as their abode deserts which appear to be continuous. The regions of Africa, indeed, that border on the Mediterranean, support some animals which are natives of all the coast of that sea, and which, consequently, are found also in some parts of Europe. Before commencing a detail of the geographical distribution of African serpents, I may be permitted to strengthen my remarks, by citing several curious facts drawn from the distribution of other animals inhabiting that continent. The number of animals scattered over the surface of Africa, without exhibiting local differences, appears to be rather limited, and these animals belong to species of great size, such as the elephant, the giraffe, the hippopotamus, the common crocodile, the lion, &c. Among the animals common to most parts of the grand African plateau, a great number of ruminants are chiefly distinguishable; such, for example, are the Cape Buffalo, of which M. Rüppell brought home the spoils from Abyssinia; the Antilope strepsiceros, which inhabits the Cape, Abyssinia, and the coast of Guinea; the Antilope equina of Senegal, probably identical with the Ant. leucophœa of the Cape; the Antilope oreotragus, which is found at the Cape, in Ashantee, and in Abyssinia; the Ant. pygarga (of which the young is Ant. personata), which is found at the Cape, and on the Gold Coast, &c. Many other animals are equally found in lands very distant from each other; as, for example, the Phascochœrus communis, which is the same at the Cape and at Senegal; the Sciurus setosus is equally proper to those two regions; as are also Myoxus murinus, Canis pictus, Gulo mellivorus (the Ratel), the Geometric Tortoise, and others. A no less considerable number of animals, on the other hand, present, in those different African localities, local varieties sometimes very curious. Thus, we find the Cape Jackal, Canis mesomelas, replaced in the northern parts of Africa, by a variety with bright tints, without the black on the back (Canis variegatus et Anthus?) of the Frankfort Museum; the Hyrax

and Zorilla of the Cape do not differ from those of the north of Africa, but by deeper colours; the Genette of the Cape (Viverra Genetta et Felina*) inhabits also Spain; but it is replaced in Senegal and Abyssinia, by a local variety remarkable for its very pale hue (Viverra Senegalensis); the Ichneumon of Egypt (Herpestes Ichneumon) is replaced at the southern extremity of Africa by a local variety with a darker fur (Herpestes Cafer et Griseus); the same is the case with Ichneumon versicolor of Abyssinia, which has tints less clear than at the Cape of Good Hope. The Antilope mergens of the Cape is represented in Senegambia by Ant. grimmea, and in Abyssinia by Ant. Madaqua (Rüpp. *Neue Wirbelth.*, p. 7, fig. 1); the Antilope oreotragus or Lalandei of the Cape, by the Ant. redunca of Senegal and Abyssinia; the Ourilibi (Antil. montana) of Abyssinia shews slight differences from the Antelope of the Cape (Antil. scoparia), and is the same as the Oryx of the former country (Ant. Beisa, Rüpp.), which forms a race distinguished by a different disposition of colours from that of Ashantee and of the Cape. It sometimes even happens, that there exist, in each region of which I am treating, races representing the same species as the Antilops sylvatica, scripta, and decula, which are mutually represented at the Cape, at Senegal, and in Abyssinia; as the Ant. Mhorr of Barbary, there replaces Ant. Dama, of which the real country is Kordofan, Nubia, &c. Other animals, in fine, vary in these diverse places, in a manner so peculiar as perhaps to merit elevation to the rank of species :† such, for example, are the Phascochœrus Æliani, which represents in Abyssinia the Phasco. communis of the Coast of Guinea and the Cape; also the Sciurus rutilans, the representative in Eastern Africa of the Sciurus setosus of the Cape and Senegal, and several others. Facts analogous to these we have given are remarked in the classes of Birds and of Reptiles; but fearing to give too great an extent to my work, I shall confine myself in what follows to the classes of

* The difference between these two mammifera is reduced to a shade in their colour, which appears to me purely periodic.

† The Hyæna villosa of the Cape differs not from H. striata, except in its long and tufted fur, and its deeper colours.

Mammals and of Reptiles, which, besides, are more adapted to furnish convincing proofs. The Monitor exanthematicus, and M. niloticus of Egypt and Senegal, are replaced at the Cape by local varieties, with colours more deep, and a pattern more marked; they are then the Tupinambis albogularis of DAUDIN, and the Lacerta capensis of SPARMAN.* The Vipera arietans of the Cape has paler tints than that of Nubia or Abyssinia; the same holds good with the Toad of the Cape (Bufo pantherinus, BOIE), which there replaces the Bufo Arabicus of Egypt, with a less agreeable system of colouring; the Naja Haje of Egypt is represented at the Cape by the Naja nivea; and there is found at the Cape a variety of the Agile Lizard (Lacerta pardalis), which is a native of France and Spain. Certain Tortoises afford extremely curious examples of the influence of climate† on animals, or of the differences which are often presented, in different countries, by species which are modelled on a single type. The great Land Tortoise of the Cape (Testudo pardalis, BELL) has also been brought from Senegal and Abyssinia; but, instead of having its shield ornamented with a beautiful design in black and yellow, this part is of an uniform yellowish-grey, a tint which pervades all the rest of the body; in fine, all the appendages of the skin have acquired, under the influence of so genial a climate, a stronger development; so that the scales of the fore feet have all been transformed into points or even into spines: this local variety is known under the names of Testudo sulcata or T. calcarata. The Testudo angulata of the Cape, which is also found at Sierra Leone, has undergone, in the latter place, changes analogous to those which I have mentioned as taking place in the T. pardalis; but, in the Tortoise, of which we now speak, this influence of a different climate is especially ex-

* See the review of the genus Monitor in the third number of my *Abbildungen*, where I have corrected the errors committed by naturalists in determining the species of this genus.

† I trust that no one will compare my mode of considering the expressions, *race*, *local variety*, or what depends *on climate*, with the ideas of BUFFON, who would willingly unite into one species all the hares in the world; or still less those of LAMARCK, who attempts to prove the possibility of transmutation of the orang-outan into the human species.

erted on the development of the shield and its edges: (this race forms the genus Kinnyxis of Bell.) We shall, in the last place, make mention of a no less curious difference between the Emys, found at the Cape, in Senegal, and in Madagascar: we may regard the Emys galeata of the Cape as the typical form, being one of the best characterized species of the genus: this Emys is replaced in Abyssinia by the Emys Gehafie of Rüppell, which differs from it only in some slight but constant characters.* At Madagascar we see, instead of these two varieties, a different race, the Sternothœrus nigricans; which, though modelled on the same type, is constantly distinguished from its representatives by a more heavy form, a shield less broad, and a cuirass partially moveable.† In recapitulating what we have said on the influence of climate on the animals of Africa, and thence deducing general principles, we arrive at this result, that the difference among animals, which mutually represent each other in Southern and Northern Africa, often resolves itself into a development of certain parts more or less complete, and into a diversity of colour; those inhabiting the latter regions ordinarily exhibit a livery of yellow or pale grey,—a colour most suitable for animals inhabiting those desert places,‡ and which I would willingly name the *Colour of the Desert.* The limited state of our knowledge respecting the animals of Africa in general does not permit us to give an exact table of the geo-

* The characters are confined almost wholly to slight differences in the form of the pieces of the cuirass; a difference so frequent in Chelonians.

† I hope that I have shewn in my work on the Chelonians, inserted in the Fauna of Japan, the small importance of the characters drawn from the mobility of the cuirass, and demonstrated that very often this character is purely accidental, or the effect of age. In every case, and adopting even the specific difference of this last species of Emys, I believe that we should destroy the natural affinities, if we elevate this animal from an isolated character to the rank of a species, and thus separate it from its African representatives. We may state, that this Emys is to its representatives, what the Emys Pennsylvanica is to the Emys scorpioidea of Surinam.

‡ As for example, most of the Antelopes of the North of Africa, the numerous species of Foxes of those countries, the Dipsas, the Hares, and several Gnawers; besides a great number of birds and of reptiles, as the Agami of the Desert, the Cameleon, the Eryx, the Cerastes, &c.

graphic distribution of serpents in that quarter of the world, and still less to assign to each species the precise limits which determine the habitats which Nature has assigned to each; not knowing in an exact manner, so to speak, more than the productions of the three or four principal points* of this continent which have been explored, we find ourselves constrained to limit our indications of species, and of the places where they have been observed. Africa is, in general, much less rich in reptiles, and notably in serpents, than Asia and America. The number of genera is equally circumscribed in that continent; but we find among reptiles the same phenomena which are observed in the other animals and plants of that part of the world; namely, that the species of certain genera are extremely numerous, and that these different species often inhabit the same places: a fact which applies also, though less extensively, to New Holland. These are, in general, animals inhabiting plains, the number of species of which is multiplied in Africa. It is thus we see at the southern extremity of that continent three or four species of Land Tortoise, four species of serpents of the genus Coronella, as many of the genus Naja, and three of the genus Vipera. The other genera of serpents there produced, have only a single species to represent them. These snakes, almost without exception, pertain to species peculiar to that continent. Some are found on the coast of Guinea; such as the Lycodon of Horstock, and the Naja rhombeata: the Psammophis moniliger is also found there; but it forms a local variety approaching to that inhabiting Egypt. In Senegambia, three species of Tree-Snakes of the genus Dendrophis are found, different from those of the Cape, one of which, D. picta, is spread over a great part of Asia, even to New Guinea. The intertropical regions of Africa support the Two-rayed Python, the native country of which extends even to China, and the Island of Java. The Lancing Viper of the Cape, Vipera arietans, is also found in Abyssinia, where it forms a local variety with pale

* Egypt as far as Abyssinia, Algeria, one part of Senegambia, and of the coast of Guinea, the Cape Good Hope.

tints. Northern Africa produces several species of serpents differing from those of the rest of Africa; such as the Eryx and the Vipera Echis, which are found also in Hindustan, the Cerastes, the Dipsas, and several Colubri. Other species, like the Naja Haje, the Psammophis moniliger, differ more or less from their representatives in Southern Africa. The regions of that continent, bordering on the Mediterranean, support several species which are also found in Southern Europe; and this analogy, between the animals in these two parts of the world, is particularly sensible on comparing those of the coasts of Barbary with the animals of Spain and Portugal, countries which, by the nature of their productions, approximate more to Africa than to Europe.* No serpents have yet been observed in the islands situate in the meridian of Africa; and it may be considered as certain that the Canaries do not furnish a single species.†

The large island of Madagascar appears to belong to Africa only in its western part, or on that side of the chain of mountains which passes through the whole length of that unexplored land. It resembles India in the productions of its eastern side, the only part of which we know any thing. This vast island, however, presents a Fauna altogether peculiar in many respects; and we might perhaps apply the same remark to the adjacent islands. In those regions, the Dodo was formerly discovered; and there also are found the Lemurs, and the anomalous species known under the name of Cheirogaleus, the Aye-aye, the Cameleon with a forked nose (in which the nasal prominences are subject to variation, and which has been introduced into several other isles), the Ptyodactylus fimbriatus; and, with the exception of the Tropidonotus schistosus, which also inhabits a great part of Asia, all the serpents of this country belong to peculiar species. We may cite

* The Iberian peninsula produces the Cameleon, the Genette, an Amphisbœna, and many birds unknown to the rest of Europe.

† I should here observe, that the reptiles of Teneriffe belong to European species; but that all the Saurians of that Island have colours extremely dark: there is found the ocellated Schink, the Wall-Lizard, and the common Frog.

the Langaha, an anomalous and very curious species of Dryiophis, the Herpetodryas Goudotii, and H. rhodogaster, the Dipsas Gaimardi; all peculiar to Madagascar. The Mascarine Isles produce a very handsome Coluber, C. miniatus, and a small Boa of a gracile form, and slender tail (Boa Dussumieri). Only a single serpent of the genus Psammophis is known in the Seychelles.

If we except the two Indian peninsulæ, *Asia* is not very abundant in reptiles. This observation would appear correct, although some other parts of Asia have not been so often explored as those already named. This is readily explicable by the position of Asia, a large portion of which is situate in the temperate and frigid zones, regions little favourable to the multiplication of reptiles. Northern Asia, or rather Siberia, produces a great many animals that occur also in Europe; and the same holds good with serpents.* A curious Ophidian, peculiar to the southern parts of Siberia, is the Trigonocephalus halys, intermediate in structure between the Vipers of Europe, and the Trigonocephali with plates covering the head. The deserts south of the Caspian Sea, which are prolonged to the borders of Hindustan, on the one hand, and, on the other, stretch by Iran to Arabia and Syria, to join those of Africa, produce a small number of reptiles, which equally inhabit the similar deserts of the latter continent. There have been observed the Monitor exanthematicus, the Stelliones, the Agama of the desert (Lacerta aurita, Pallas), the Vipera echis, the Psammophis lacertina, and the Eryx, which extends to Siberia, but forms in India one or more local varieties or distinct races. We are in absolute ignorance with regard to the reptiles of the rest of Central Asia; but the known animals of China, at least those of the neighbourhood of Canton, often present a strong analogy to the productions of the Islands of the Great Indian Archipelago. Before

* Most travellers agree that our Tropidonoti, our Viper, our Lizards, &c., are found in Siberia; but not admitting facts into my work that are not founded on dissections of the subjects themselves, or on good figures of the animals, I have but rarely availed myself of the remarks of travellers.

speaking of the two Indian peninsulæ, which it is convenient to approach from Malayan Asia, I must say a few words on the islands composing the empire of Japan, which approximate in their productions to the temperate regions of Asia and to Europe; while their southern parts exhibit an identity with intertropical Asia. The study of the animals of Japan offers the most beautiful results for the justification of my method of investigation; namely, the grouping together the animals which being modelled on the same type, are the mutual representatives of each other in the different countries of the globe; and comprehending them under the same specific name, admitting, as sub-divisions, the local varieties, or those due to climate. The results which we obtain by means of this mode of study, will serve at the same time to destroy the prejudice, that allied species are so rigorously separated from each other, that we can establish perfectly distinctive characters for each. Several Mammals of Japan* are not distinguishable from those of Europe: there exists in that empire a badger, absolutely the same as ours, but with darker tints, and a less powerful form; the Mole of Japan differs from that of Europe by a colour somewhat lighter; the Pine-Martins of that country have the spot under the throat more yellow than in ours; the Fox and the Otter are entirely similar to ours; the Squirrel approaches to that variety of squirrel living on lofty mountains of Europe. Other mammifera of that country differ from those of Europe; thus, in the Island of Jezo is found a large Bear, probably allied to the Grizzly Bear of the Rocky Mountains; while in the other isles of that empire are found the Bear of Thibet; an Ape (Innuus speciosus); a new and very curious Dog (Canis viverrinus); two species of Flying Squirrel (Pteromys), one of which is very large; a Chamois analogous to the Antilope Sumatrensis, and A. montana of the Rocky

* The numerous researches made in Japan by M. Von Siebold, and more lately by Mr Bürger, have put us in possession of most of the productions of that empire: having a great number of specimens of each species before my eyes, we may be sure of the facts which are advanced in the following pages.

Mountains ; and lastly, several unpublished mammifera of small size. The number of Birds which inhabit both Japan and Europe, amount to more than one hundred species : many of them, as the aquatic birds and birds of passage, are absolutely identical with ours ; but the stationary species, or those that lead a nomadic life, without quitting the larger islands under consideration, often present differences, more or less marked : the Jay of Japan has an arrangement of tints somewhat different from ours, and it also differs from the variety found in the Himalaya Mountains. The Titmice, Parus major, P. laudatus, &c., are considerably less in Japan than with us ; the colours are slightly different, and the last species also recedes from our variety, inasmuch as it suspends its nest from the branches of trees, almost like our Parus pendulinus ; the Japanese individuals of the Wagtail (Motacilla alba), are of the variety known by the name of Mot. lugubris ; the Quail, the great Curlew, the Sylvia cisticola of Japan, exhibit differences when compared to those of Europe, &c. Lastly, many other birds of Japan differ more or less from those of Europe, but they often shew differences so slight, that ornithologists even have not always believed it necessary to particularize them (see TEMMINCK, *Manuel*, III. p. 50, *et seq.*) I need not speak of the fresh-water Fishes of Japan, many of which represent our European species ; these last often exhibiting differences between one district, or one river, and another, it would be useless to indicate the difficulty of determining, with exactness, those of Japan. The Reptiles of that country furnish the very remarkable fact, that the Saurians and Ophidians, without a single exception, belong to species which do not occur in Europe ; whilst we find, among the two other orders of reptiles, analogous races of the same species in both countries : such are our two Frogs and the Tree-Frog (Rana esculenta, R. temporaria, and Hyla arborea), which are absolutely identical with those of Japan ; then our Common Tortoise, Emys vulgaris, known also under the name of Emys Caspica, and E. lutraria, forms in Japan a constant local variety ; the Toad of Japan, although very nearly allied to ours in

form and colour, differs, however, in several points of structure. The Snakes of Japan, besides the Hydrophis, may be reduced to three species of the genus Coluber, two of Tropidonotus, and one Trigonocephalus. The presence of this last, as also that of a Trionyx, of the Musk Shrew, and of the Great Flying Squirrel, recall the Indian Fauna; while several others, as the five-rayed Scink, several Salamanders, &c., demonstrate that there also exist relations between the Fauna of North America and that of Japan. An examination of the productions of the two peninsulæ of India, comprehending the Island of Ceylon, shews us, that a great analogy exists between those countries and the isles of the Great Indian Archipelago; and this analogy becomes much more striking, when we compare the animals of the nearest points of the countries we have mentioned; as, for instance, those of the peninsula of Malacca to those of Sumatra. This analogy, however, is not so evident in respect to mammifera* as to birds, to reptiles, to fishes, and especially to the productions of the vegetable kingdom; and there exist in the peninsula on this side the Ganges, several reptiles peculiar to that region, and even pertaining to genera which are not found in Malayan Asia; as, for example, Cameleons, Vipers, &c. The Isle of Ceylon, although very near the coast of Coromandel, supports several animals† which do not inhabit the latter country: among serpents there are the Tortrix maculata, the Calamaria scytale, the Lycodon carinatus, and two Trigonocephali, the T. hypnale, and T. nigromaculatus. It is in those latitudes that we first detect the genus Hydrophis; interesting ophidians that inhabit exclusively the sea, and occur, from this point, in all intertropical latitudes east of Malabar, even to Polynesia. The number of serpents which are found in the two peninsulæ of the Ganges, without occurring in Malayan Asia, appears to be very limited: such are the

* The Monkeys of Malayasia, for example, belong, without exception almost, to species different from those of Bengal, of the Indian Peninsula, or of Ceylon.

† The Lion-Tailed Monkey, or Ouanderou, and several Semnopitheci.

Eryx, the Coronella Russeli, and Cor. octolineata, several species of the genera Coluber and Lycodon, the Dipsas trigonata, several Tropidonoti, the Elaps trimaculatus, and several Vipers. The productions of the Indian Peninsula beyond the Ganges having been very little studied, we pass on to Malayan Asia, which offers one of the most curious regions of the globe for studying the geographic distribution, not only of animals, but also of vegetables; and the results obtained by this study will greatly contribute to confirm the ideas which we have so often stated in our work, on the innumerable modifications which animals of the same stock present, in the diverse countries they inhabit. The islands which compose the Great Indian Archipelago belong to islands of the first order, and are surrounded with numerous reefs or islets, more or less considerable. Situated under the tropics, covered with a luxuriant vegetation, and peopled with a vast number of animals of all classes, they are separated from each other by arms of the sea, mostly very narrow, but which form an insurmountable obstacle to the majority of animals.* At once, then, on observing on several of those isles the same species, we may be certain that the animals on different islands having no communication with each other, would form on each of these isles an isolated family, the individuals of which living since their creation, or at least since those isles received their present form, in places differing more or less in their nature, should exhibit modifications more or less sensible. Experience, in fact, proves the truth of what I state. It often happens that the same species of animal has been discovered in Sumatra, Java, Borneo, Timor, Celebes, and even in the

* Besides the Archipelago of Malayan Asia, that of the Great Antilles is the only other point on the globe which offers a favourable position for the comparative study of individuals of the same species, inhabiting at once several countries separated by the sea; but these last islands are almost all situated under the same parallels; they are neither so numerous, nor so large, nor so distant from each other, as those of Malayan Asia; besides, they are much less rich in objects of natural history, and have been but little explored, in comparison with the Isles of Malayan Asia, which have, for more than twenty years, been the object of the assiduous researches of our travellers.

Philippines, or on the continent of Asia; and that it shews, in each of those places, differences, indeed often very slight, but usually constant. We ask, how are we to dispose of these local varieties? Are we to consider them as such, or as races of the same species, or are they deserving of being elevated to the rank of species? The attempts which I may be said to have made to accommodate my views to Nature, lead me to conclude, that to designate each of such petty varieties under a proper and specific name, would tend to the confusion of science; and that it would be more profitable to recognise one only of the conditions which modify the nature of animals, than to augment the catalogue of them with many new names. I know that my readers will have difficulty in forming an idea, from description, of all the minute modifications which the same species undergoes in different places, and that it is often difficult to indicate them; but not being able to place before their eyes those immense collections, and those numerous series of individuals of the same species, in a word, the materials which have served as the basis of my work, I am obliged to state some facts in justification of my manner of viewing the question. Let us take our examples first from the Mammifera.

The most common monkey, that most widely spread through the Indian Archipelago, is the Macaque of Buffon, the Hare-lipped Monkey of Pennant, Cercopithecus cynomolgus. The ordinary variety of this species comes from the Island of Java; it is constantly of a greenish tint, and the hairs of the head are a little elevated into a sort of tuft; the specimens from Timor resemble those of Java in all respects, except that they have deeper tints, and that their fur is more close, which gives them the appearance of having the limbs less slender than the individuals from Java: those from the Island of Sumatra often have the back of a reddish tint; their face is somewhat more black than usual; the hairs of the head shorter, and incapable of being raised into a tuft: the race of the Island of Borneo is, in some measure, intermediate between that of Sumatra and Java, having the tint of the fur of those of Java, and resembling those of

Sumatra in the want of the tuft, and in the colour of the face: lastly, we have received from Siam a monkey quite analogous to the Javanese variety of our Macaque, but the tail of which is a little longer than in the latter. Not having an opportunity of examining a complete series, I am doubtful whether the slight differences that exist between the individuals of the Civets (Viverra zibetha) of Java, of Sumatra, of Siam, of Borneo, and of Amboina, which I have seen, are constant or accidental. Similar reasons restrain me from announcing my observations on the Viverra Lisang, of which we possess specimens from Siam, Sumatra, and Java. The Paradoxurus typus is spread over Bengal, Siam, Sumatra, Java, Borneo, Amboina, Timor, &c., and forms, in those different places, numerous varieties, which are chiefly distinguishable by the tint and distribution of the colours, but sometimes also differ in size: in Sumatra, for example, the species is stronger than in Java; in Java stronger than in Timor, &c.;* there appears to exist in several places a variety with a white tip to the tail; and the individuals from certain parts of the Island of Java have a pale yellow fur, with three stripes down the back. The Sciurus bicolor has a fur less variegated with white in Sumatra and Malacca; in Java and in Siam it has the back of an uniform blackish-brown. The Squirrel of Raffles has, in Malacca and Siam, the body variegated with very pure white: in the specimens from Borneo, on the contrary, this colour is constantly mingled with a darker tint. The numerous varieties of the Great Indian Squirrel (Sciurus maximus) which inhabits Bengal, Malacca, and Sumatra, are in a great measure accidental. I was never able to establish any specific distinction between the Tupajas of different parts of Asia, of which I have examined a number of individuals brought from the continent of India, from Sumatra, from Borneo, and from Java;

* The series of specimens of this species which is exhibited in the galleries of the Museum of the Low Countries, alone presents a special object of study, and points out to us what materials are required for giving a complete idea of a single species, when we desire to know more than the name, and the principal distinctive characters.

and I dare not decide this difficult question, on account of the great changes which these animals undergo from age, especially in the form of the cranium; it is, however, proper to state, that the Tupajas of Java never arrive at so great a size as those of Sumatra and Borneo. The Common Boar of India, Sus vittatus, has been brought by navigators from Java, Sumatra, Borneo, and from Timor; but the differences which exist among individuals from those different places are so trifling, that it is not worth the pains to distinguish them. The Stag of the Moluccas is of a size considerably inferior to that of Java, Cervus russa, although it evidently belongs to the same species. The Small Cat of India, Felis minuta, Javanica, or Sumatrensis, presents in its tints discrepancies, more or less marked, according as the species inhabits Java, Sumatra, Malacca, Siam, or Bengal; and we observe, besides, a great number of accidental varieties. The Pigmy Indian Musk, Moschus javanicus, becomes a little larger, and presents darker tints in Sumatra, Moschus napu. It is also found in the Isle of Bangka, Penang, and the Peninsula of Malacca; the individuals from Borneo attain a larger size, and those of Siam shew a different disposition of colours, although the physiognomy of that race is quite the same as that of Java. The Dwarf Squirrel, Sciurus melanotis (which, by its extremely small size, is to the other squirrels what the Falco cœruleus is to the rest of the Falcons) inhabits Java, Sumatra, and Borneo, and presents, in these different countries, local varieties, more or less constant. One of the squirrels most common in India is the Sciurus nigrovittatus, which, during certain seasons of the year, losing the greyish-black colour of its belly, then forms the nominal species introduced into systems under the names of Sciurus plantani, S. ginginianus, and S. bilineatus: this squirrel lives in Java, Sumatra, Malacca, China, &c.; it presents, in these different parts of the world, many varieties, but their characteristics are so minute, that I should not dare to describe them, without having examined a great number of individuals of each variety. Lastly, I shall only mention the differences, often

very marked, which the same species of the Cheiroptera present in different countries; and I may add, that there exist among them differences, even in the essential characters, as in the length of the muzzle, &c.—See Vol. II. of *The Monographies* of M. Temminck.

As to Birds, there exist a great number of species which live at the same time in different islands of the Archipelago, there forming local varieties, sometimes very curious, but which are chiefly confined to differences in size, and the system of colours.—The class of Reptiles presents analogous facts to those observed among mammifera. The Emys of Spengler is often seen under forms so different, that the study of this animal serves only to confuse the idea attached to the word *species*.* The two-rayed Monitor, Mon. bivittatus, which is found in Sumatra, in Java, in Borneo, in Celebes, and also in the Isle of Luçan, varies more or less, according to the place which it inhabits; whence several naturalists have considered it as constituting different species, although their differences often resolve themselves into trifling discrepancies in the system of colouring. The same observation, perhaps, is also applicable to the Indian Basilisk that inhabits Celebes, Amboina, and the Philippines. The Scink of Kuhl appears to be spread over India, from Bengal to the Philippine and Marianne Islands: the individuals from Bengal, Sumatra, Java, Borneo, and Celebes, offer no sensible differences; but those from Timor have more vivid and more decided tints. As to the Dracones, it is scarcely possible, in a few words, to give an abstract of all the differences which each species presents, according to the different place it inhabits.† The Spotted Gecko (Lacerta Gecko, Linn.) of Timor presents tints a little darker than that of Java. The Crab-eating Frog and Rana leucomystax, which are absolutely identical in all the Sunda Islands, and also in the Philippines, depart from the typical race at

* All that we might offer, to prove our assertions, would be superfluous: dissection can alone justify our ideas on this point.

† We beg leave to refer to the third number of our *Abbildungen*, where we have very amply treated of this subject.

Timor, by a slightly different system of colouring, and thus form a constant variety, either local or climatal. The Najas of the Sunda Isles constantly differ in several characters from those of Bengal and of the Philippines. The Ceratophrys of Sumatra forms a local variety or a race, different from that of Java. The Serpents are not less fertile in examples of this nature than the other orders of Reptiles. We find that individuals of the Tortrix rufa of Celebes are distinguished from those of Bengal and of Java, by a back of an uniform tint, and by two small spots on the occiput. The Calamaria oligodon found at Java, presents, at Sumatra, a disposition of colours a little different on the back, and forms, at Ceylon, and in the Philippines, a third very handsome local variety. Analogous differences exist between the Coronella Baliodeira of Java and Sumatra. The Lycodon Hebe of Java has a less size, and tints a little different, and less bright, than those of Bengal; the specimens from Timor are smaller than those of Java, and have a deeper colour. The beautiful black-tailed snake, Coluber melanurus, inhabits Java, Sumatra, and Celebes; but individuals from the latter have the nape constantly ornamented by an angular black mark, while those of Sumatra have the back rayed with black. The Herpetodryas oxycephalus is of a fine grass-green in Java; this tint verges on brown in specimens from Borneo, and those from Celebes have all the upper parts of a very deep blackish-brown. It will suffice to say, that the Dendrophis picta inhabits most of the intertropical countries of Asia, and from the Senegal even to New Guinea, to enable us to guess how this species must vary in countries so far distant from each other. The Dryiophis nasuta, which usually comes from Bengal and the Marianne Isles, has the belly streaked with yellow at Java. The Dryiophis prasina, common in the Isles of the Straits of Sunda, forms a local variety at Celebes; the Tropidonotus quincunciatus, which is one of the most widely spread serpents in India, shews at Java confluent spots, so that the upper parts are streaked with black. The Tropidonotus chryargos of Sumatra is distinguished from that of Celebes, and both from that of Java; and this difference, produced by a different arrangement of the colours,

appears to be constant in all these localities. The Homalopsis of Schneider, which inhabits India even to New Guinea, presents, in these different localities, numerous petty differences, of which the greatest number appear accidental. The Great Two-rayed Python comes from the Straits of Sunda, and from China; it inhabits the two peninsulæ of India, the isle of Ceylon, and is found even in Senegambia, probably existing in a great part of intertropical Africa. I consider all those Pythons as pertaining to the same species; but I know not if several naturalists may not perhaps discover various differences between individuals from these different places, sufficient, in their eyes, to establish several subspecies, which will necessarily involve the establishment of the species as a subgenus. The Elaps furcatus and E. bivirgatus present, at Sumatra, a different arrangement of colours from those in Java. Finally, I could fill a separate volume in describing all the minute modifications experienced, in those different regions, by each isolated family of the same species of animals, of which the number is so immense in that part of the world. Each of these regions, however, produces species which are peculiar to itself, or which are only found in some of them. All the world knows that the islands of Sumatra and Borneo produce several animals, and some of those too of large size, which are not found in any other point of that Archipelago, not even in Java, which, on the other hand, produces certain animals which do not appear to inhabit the other islands. One is tempted to consider the geological constitution of the land as determining the distribution of animals; but experience shews us, that it has only a secondary or indirect influence, inasmuch as it modifies the nature of the soil, or as it determines the age of those islands or regions. The climate, which does not always influence even the distribution of plants, does not generally present an obstacle to that of animals, particularly where there is a concurrence of the other conditions necessary to their existence, and when they can find, throughout the year, the food which Nature designed for them.* It is

* The Orang-outan and the Semnopithecus nasutus, for example, live

wrong, then, to suppose, that a being which inhabits a country of volcanic origin, can never be found but in soils of a similar kind; or that soils of a primitive formation ought to nourish only particular species. Supposing, even, that this should be the case, as in Java compared to Sumatra and to Borneo, it would be unsafe to attribute these differences to the different age of the former isle, and to the defect of a soil or of a food proper to the existence of the animals. It is, therefore, difficult, if not impossible, to class these countries, according to their productions, into cantons, or to seek to establish regions, as has been done for the distribution of plants, on the surface of certain countries. As to the Great Indian Archipelago, we find that the islands of the Straits of Sunda offer, in their productions, many analogies with the neighbouring parts of the Asiatic continent, and even with those of Bengal, and the Indian Peninsula. The isles of Sumatra and of Borneo support a vast number of animals, and some of great size, which are not found in Java; but there is also, in the animals of small size, a very great analogy between the southern part of Borneo and the island of Java. This last isle produces several animals that are also found in the southern parts of China, and probably also in the chain of islands that extends eastward to Timor. It is in the vast island of Celebes, that several forms of animals, unknown in the islands of the Straits, begin to shew themselves; these novel forms become more numerous in the Moluccas, and assimilate to those peculiar to New Guinea, which in several instances recall, in their turn, the heterogeneous productions of New Holland. The Philippine Isles offer an analogy with those of the Straits of Sunda; and, what is curious, we there observe several animals of Ceylon and of India. In confining ourselves to the observations suggested by the classes of Mammifera and of Reptiles, we see that the principal characters that distinguish the Fauna of these islands are the following:—The

in Sumatra and Borneo, in places entirely analogous, and never frequent situations of another nature; they do not diffuse themselves over the whole island, although they are not hindered to do so by any physical obstacle: it is thus also with most other animals.

Island of Sumatra is the only one of all the isles of Malayan Asia that produces the Elephant; the Indian Tapir* is also found in Borneo; and these animals at the same time inhabit the Asiatic Continent. The Great Stag of Sumatra, Cervus hippelaphus, Cuv., is found in Borneo, and probably also in the Peninsula of Malacca. The Hylobates syndactylus and Semnopithecus melalophos, from which the S. flavimanus does not appear to differ, have yet only been found in Sumatra; but it is asserted that the Lar of Raffles, Hylobates Rafflesii, to which it is necessary to refer the Hylob. agilis and H. variegatus, inhabits also the isle of Celebes. The Gymnurus, a great terrestrial insectivorous animal, and the great black Chamois, Antilope Sumatrensis, have never yet been seen except in Sumatra; but the curious Gnawer, described by M. Temminck under the name of Nyctocleptus, and the Long-tailed Porcupine, inhabit also Malacca. It appears that the island of Sumatra has a peculiar species of Rhinoceros, if perhaps the Rhinoceros of Borneo does not belong to the same species. Several other animals are found at the same time in Sumatra and Borneo, which have not been observed in the other Malayasian islands; such are the Orang-outan, the Semnopithecus nasicus and S. cristatus, the Innuus nemestrinus, the Felis macrocelis, the Ursus Malayanus, which also inhabits Celebes; besides several squirrels, belonging partly to new species, some few of which are found in Malacca, Siam, and China, but have not yet been found in Java. The isle of Sumatra has several Chelonians in common with Borneo; but the Saurians and Batrachians belong, for the most part, to species also inhabiting Java. In glancing at the picture which we have sketched of the geographic distribution of Ophidians, we see that the serpents of Sumatra also inhabit Java, almost without exception, and that a good number of them are equally found in India and Bengal. The Trigonocephalus Wagleri, on the contrary, appears to be found

* It should be understood, that the observations on the absence of certain animals, in certain regions, cannot always be regarded as positive. We can only judge from what we know; and new discoveries may doubtless produce modifications of these assertions.

in no other island of Malayasia, but Sumatra and Borneo, where our travellers discovered it. *Java*, the most beautiful and best known of the Malayasian isles, differs from the other regions of this grand archipelago in this, that it produces several animals which are peculiar to it, whilst it wants a good number of those which are common in Sumatra, in Borneo, and even in the continent of Asia. We have no certain proofs that the Elephant ever lived in Java; the Indian Tapir, the Orang-outan, the Semnopithecus nasicus, the Hylobates syndactylus, the Malayan Bear, the Innuus nemestrinus, and many other animals of Sumatra and Borneo, do not inhabit it. No Antelopes are found there. The Two-horned Rhinoceros of Sumatra is there represented by a one-horned and very different species, which seems to have a great affinity with the Rhinoceros of continental Asia. The Stag of Sumatra is there represented by a less beautiful species, Cervus Russa; the Leopard of Sumatra and of Borneo, Felis macrocelis, is represented by a species resembling the African Leopard, but with very small spots, with a long tail, of a less size,* which appears to be peculiar to Java. Exclusive of the Hylobates syndactylus of Sumatra, each of the isles or the principal regions of intertropical Asia, appears to sustain a single species of the genus Hylobates, more or less differing from each other. The Hylobates Lar of Sumatra is represented at Java by the Wou-Wou, Hylobates leuciscus; and this is replaced at Borneo by a race with darker tints, the Hylob. concolor, or H. Harlanii. None of these species ever appear to be found on the continent of India; for the Hylobates which have been brought from Siam, and some

* I can assert that all the Leopards of Java belong to the species called by M. Temminck, Felus Pardus, and that the true Leopard, which is distributed over a great part of Africa, from Barbary to the Cape of Good Hope, and which is said also to inhabit India, is never found in Java; but there exist in that isle also individuals of the Pardus, with the tail much shorter than ordinary, and thus approaching nearer to the common Leopard; this is in favour of the opinion that the Leopard of Java should be considered as a race or local variety of the other. This opinion is, on the other hand, strengthened by the existence of several local varieties or races of the Lion in Africa, and in Asia, of the Leopard of Africa, &c.

other points of the peninsula beyond the Ganges, belong to a species known under the name of Hylobates albimanus, which is the great Gibbon of BUFFON, or the true Lar of GMELIN. Of the two Semnopitheci common in the Isle of Java, one, the Semn. mitratus, is peculiar to that island; but there is found in Siam a monkey entirely analogous, though with darker tints; the other, the Semn. maurus, has never been observed in any other part of the globe; but this species is evidently replaced in Sumatra and Borneo by the Semn. cristatus or pruinosus, which appears not to differ from the Maurus but by its fur being mingled with grey. A third species is said to exist in the eastern part of Java, but we have not yet received from that island the Semn. auratus* or pyrrhus, which appears to belong to a species that inhabits the Isle of Borneo. Java is far less rich in squirrels than the other isles of the Straits; we there find the Sciurus bicolor, S. nigrovittatus, S. insignis, and S. melanotis, but none of these species are peculiar to that island. The Tupajas do not there attain the great size of those of Borneo and Sumatra. The Royal Tiger, which does not seem to inhabit Borneo, nor any other isle of Malayasia, with the exception of Sumatra, here forms, as in the latter island, a local variety, with very short hair; and this variety forms the extreme opposite to the Tiger of the North of Asia, to which the long fur gives a very different appearance.† The Island of Java breeds a fine Boar of very large size, Sus verrucosus, differing much from another species, Sus vittatus, which inhabits equally Java, and almost all other parts of Malayasia. One of the most remarkable quadrupeds of Java is the Wild Buffalo, the *Banting* of the na-

* The yellowish livery of this monkey is evidently periodic, or perhaps due to sexual difference. The specimen in the Museum of Paris presents indications of black hairs on the extremities; we have specimens in our museum in the livery of moult; others are wholly black, with the exception of a yellow stripe on the inner part of the feet, and under the tail.

† On comparing in our museum specimens of the Tiger of Corea with those of Java, we may convince ourselves of this effect of climate, particularly on examining the relative thickness of the tail: in the first, this member appears about the thickness of the arm; in those of Java it has that of a man's thumb.

tives, which is probably also found in Borneo and Sumatra, and appears scarcely to differ from the *Gaour*, Bos frontalis, or Sylhetanus, of Bengal, of which it probably forms a variety.* As for Birds, we shall content our-

* A fact worthy of notice is, that the domestic Ox of the islands of the Straits belongs to a species totally different from this wild one. The first, which they name Carbau, and which has returned to the wild state in Sumatra, is descended evidently from the Arni or Wild Buffalo of Hindustan; this renders it probable, that the introduction of that buffalo into the Sunda Isles, remounts to the remote epoch from which we date the introduction of the culture of rice, which they are said also to have received from Hindustan. However this may be, the remarks which we have made prove that the study of the distribution of the domestic animals may serve to elucidate several obscure points in the history of the human race, and that it may contribute to our knowledge of the state of civilization among the primitive inhabitants of Java, who are believed formerly to have played so important a part. (See the Travels of CRAWFURD, and the work of W. VON HUMBOLDT, entitled *Uber die Kawaisprache*.) Another fact, no less curious than that of which we have spoken, is that the Italian Buffalo, brought into Europe in the middle ages, appears equally descended from the Arni, which is thus spread from China to Abyssinia, and Italy. These two facts proved, we obtain a very curious point of comparison for studying the influence of different climates upon these animals, which, in the European race, seems to be especially concentrated on the curvature of the horns, and on the cavities of the front, phenomena otherwise very common in domestic animals. As to the domestic Ox of the rest of Europe, which seems also to belong to the domestic race of Japan, and has been spread over almost every country of the earth, since the discovery of America, and the opening of the sea passage to India; as to this Ox, I say, there is reason to believe, that it also came from India in the remotest ages; the reasons are, 1. That the Zebu, the most common domestic Ox in the continent of Asia, which is, at this day, transported as our horned cattle, sometimes to Java, and to other countries, belongs, without doubt, to the same species as our ox; and it forms a variety produced by the influence of climate in hot countries; 2. That the Ox of the ancient Greeks and Romans appears to have been the same as our domestic cattle; finally, That the only Buffalo which lives in Europe in a wild state forms a species totally different from our Ox, and that it approaches nearer to the Bison of North America. At least, in adopting the hypothesis that our horned cattle are sprung from a species now extinct, and denominated Bos primigenus, we are compelled to seek a parent stock for our Ox among the wild species of India. I have long fixed my attention on the *Gaour*, but not knowing, by dissection, any but the Javan race, I dare decide nothing; and I advance this opinion solely with the object of fixing the attention of naturalists and of travellers on this interesting subject. It is said that there exists in Hindustan, in a wild state, a race of bastard Buffaloes, produced between the *Gaour* and the *Arni*. The history of our domestic Dog may perhaps contribute to throw light

selves with remarking, that the Wild Peacock represents the Argus of Sumatra and of Borneo; the Great Hornbill of that island, Buceros lanatus, forms a different race from the true Buceros Rhinoceros of Sumatra and Borneo, &c. Among reptiles, the Trionyx stellatus has never yet been observed in any other of the Sunda Islands except Java, where it lives equally with the Trionyx subplanatus, which is the only Tortoise known in Borneo, Sumatra, and Malacca. The Emys trijuga* appears peculiar to Java, as also a small number of Reptiles, Saurians, and Batrachians, but which all belong to species of small size. It is a curious fact, that two of the most remarkable species of Trigonocephalus, Trig. puniceus, and T. rhodostoma, have hitherto never been observed except in Java; while the green Trigonocephalus, so common in the Indian Peninsula, in Bengal, in Sumatra, and in Timor, does not əxist in Java. The Bungari, which inhabit Ceylon, India,

on that of our domestic Ox. It is ascertained, that in demonstrating the impossibility of identity between the Wolf and the Fox and our Dog, we have at least arrived at the conclusion, that our Dog is not of European origin; but we have searched in vain for the parent stock of this carnivorous animal. I do not hesitate to adopt for such the Wild Dog of the lofty mountains of the continent of Asia, of which specimens have been sent us from Bengal, and which is also found in Sumatra, Java, and in Borneo; it is named Canis rutilans, Sumatranus, and Javanicus. In taking, for comparison, the domestic Dog of Japan, or even our Shepherd's Dog (races which have degenerated the least), we find that there exists a certain analogy between these animals and the wild dogs of India, so that it is almost impossible to doubt their identity; there do even not exist sensible differences between the skeletons of those animals, and their crania are so like, as to be mistaken for each other: the same observation may be applied to the cranium of the Esquimaux Dog. Our poultry, lastly, come without doubt from India, if not from the Wild Cock of Java, or at least from an analogous race of Continental Asia. In conclusion, I regret not to be able to develope the observations now made, by publishing the extended researches which the numerous materials collected in the galleries of the Museum of the Low Countries have afforded me, as I could confirm by dissection the views I here have advanced.

* There is found at Pondichery an analogous species, but with a head less thick, which M. Bibron takes for the true Trijuga of Schweiger: Boie deceived himself, then, in applying in the *Herpetology of Java* that epithet to the Javanese species, which it is now necessary to consider as new.

and Bengal, do not appear to occur in any other of the Sunda islands, except Java. *Borneo*, the largest of Malayasian islands, was not known at all, as to its natural history, until the excursion which Messrs DIARD, KORTHALS, and MÜLLER made into the interior of that country. The Elephant does not appear to inhabit it; but they found there the Indian Tapir, and they had positive proofs of the occurrence of a Rhinoceros there, although they did not ascertain to which species it belonged. Borneo has, in common with Sumatra, the Orang-outan, the Semnopithecus nasicus, and S. cristatus, the Felis macrocelis, the Inuus nemestrinus, the Argus, &c.: the Hylobates of that isle is so near that of Java, that it cannot be considered as a particular species; there is also found a Semnopithecus resembling the S. pyrrhus of Java; the large Stag approaches to the C. hippelaphus of Sumatra, and the Ursus Malayanus has also been seen in Borneo. The Mammifera, peculiar to the island, all belong to new species, of small size; and several curious animals begin to appear there, whose real native seat is the Moluccas: such as, among the Mammals, are the Tarsius (Didelphis macrotarsus, GMEL.) Among the reptiles are the Basilisk and others.* —It is in the Island of *Celebes* that the forms of animals, altogether peculiar, manifest themselves, or species of which no trace is found in the Isles of Sunda: such are the Phalangers, the Babyrussa, the Harpya, the Cephalotes, the Megapodes, the Antilope Celebica, the Emerald-Scink, and that with a blue tail; animals, the major part of which inhabit also the little known neighbouring isles, the Moluccas, or even (as in the case with the Little Blue-tailed Scink) the islands in the South Sea. Among the serpents of Celebes are remarked a beautiful Herpetodryas, H. Dipsas, and the Dipsas irregularis, which is also found in Amboina: several other species are identical with those of Java or Sumatra; but several among them form con-

* MM. MÜLLER and KORTHALS have arrived in Europe with a part of the rich collections, formed lately by them in Borneo: I regret not having been able to make use of it for my work; but I have profited by the verbal communications which these gentlemen have been so good as to make to me.

stant local varieties, though only distinguishable by a slightly different disposition of the colours : to this number pertain the Tortrix rufa, the Coluber melanurus, the Herpetodryas oxycephalus, the Dryiophis prasina, the Dipsas dendrophila, and the Tropidonotus chrysargus. Among the *Moluccas*, there is only the Island of Amboina of which the productions are in the least known. There are seen three or four species of Snakes which are also seen in Java ; but it does not seem that the Sunda isles afford the Lycodon modestus, the Boa carinata, the Dendrophis rhodopleuron, nor the Python amethystinus. *Timor* is in some degree intermediate, as regards its productions, between Java and the Moluccas : we find there many animals of the former, whilst there exist there a good number that also live in the archipelago just mentioned. The Python of Timor is perhaps different from that of Amboina ; a very curious Homalopsis, H. leucobalia, has been there discovered ; the Lycodon Hebe of that island has its tints deeper than the variety of Java ; and the Coluber radiatus is represented in Timor by an analogous, yet different species, Col. subradiatus. *New Guinea*, with the adjacent islands, all shewing, more or less, analogy with the other Malayasian Islands, on the other hand, approximates to New Holland, by the presence of certain animals, as the Petaurus, Kangaroos, the Perameles, &c. M. Müller has discovered a very curious Zonurus, an almost blind Acontias, a Typhlops of singular form, a very remarkable horned Frog, a new Ceratophrys, a very beautiful Monitor, a Scink of very anomalous structure, and many other very beautiful and unknown Reptiles. There also exist in that island several new species of Serpents, as the Tropidonotus picturatus, the Elaps Mülleri, species which are also found at Waigiou. It remains that I should say a few words on the *Philippine Islands*, of which the zoology is only known by a few objects, collected in the vicinity of Manilla in the Isle of Luçon, the study of which has given rise to the curious remark, that there exists a great analogy between certain productions of that island and of Ceylon. This fact is very striking, at least in regard to serpents, of which several species have never been observed, except in those two

islands. The Naja of the Philippines belongs to the ordinary variety of the N. tripudians, which inhabits India, and which is constantly different from that of the islands in the Straits of Sunda. On the other hand, we find in the Philippine Isles, several animals which probably do not exist either in Ceylon or in Bengal : of this number are the Basilisk, the Monitor bivittatus, and some others.

New Holland being too little explored, and the objects of natural history brought from thence to Europe being all collected at the same points, it is difficult to speak of the distribution of animals in this vast island. All have, elsewhere, heard of the singular productions of that country,* a few of which also inhabit Van Diemen's Land, presenting occasionally, in these different localities, differences similar to those we noticed between the same animals of several parts of the Indian Archipelago. As to serpents, New Holland produces species totally peculiar almost without an exception, the greater number of which belong to the family of venomous serpents ; no aquatic snakes have yet been found there. The distribution of other reptiles in that continent offers little remarkable ; but it deserves to be noticed, that, with the exception of marine species, it affords but a single Chelonian, the Emys longicollis : the absence of Land Tortoises is the more remarkable, that we find a very considerable number of them in the southern extremity of Africa, a country which presents many affinities with New Holland. We have already stated above, that the innumerable islets scattered through the great Pacific Ocean do not appear to produce serpents. The Mariannes are an exception to this general rule ; and Dampier speaks of green serpents which he saw in the Galapagos islands.

We now come to *America*, which presents several curious facts in regard to the distribution of animals. This division of the world is naturally parted into two great continents, each of which has a particular fauna ; but

* The Kangaroos, the Ornithorhynchus, the Echidna, the Phascolomys, and Phascolarctos, the Dasyurus, the Thylacinus, the Maenurus, the Emeu, the Phyllurus, and many others.

central America, consisting of a narrow tongue of land uniting those two continents, and the adjacent islands, sustain a great number of animals, which have one or other of the two continents as their original country. Some species of animals, however, are common to both Americas. Others abounding in North America are found under the same parallels of latitude in South America, where they also form climatal varieties. A great number of species inhabiting the southern continent are also found in Mexico, and the Antilles; while there are others, common in South America, that are diffused in North America, over Florida and Louisiana, where they often form climatal varieties. Local differences are sometimes even remarked between animals of countries less separated than those just mentioned; for example, Brazil and Surinam, or Guyana in general. Lastly, the animals of the regions situated on the western slopes of the Cordilleras, often differ specifically from those of Brazil; but certain species are the same in both regions, or at most only exhibit slight variations. South America produces a great number of monkeys, of which no race has been yet observed in North America; and these monkeys, the same species of which is sometimes found over an extent of country embracing more than 20° of latitude, must necessarily present, in places so distant, differences more or less sensible, chiefly arising from the influence of climate.* A very great number of other animals of South America have not hitherto been observed in the northern peninsula of the New Continent, such as the Llama, which may be termed

* It is stated as a fact, that the Monkeys of Paraguay cast their hair at certain seasons of the year, to be reinvested with a denser fur, a species of winter robe, which does not take place with individuals of the same species living under the equator. Add to this, first the almost incredible changes which some monkeys undergo from age, and afterwards the differences which usually exist in these animals between the sexes, and we may conceive the difficulties in the way of those who occupy themselves with the study of those animals. I cannot sufficiently recommend to cabinet-naturalists the perusal of the precious works bequeathed to us by the late RENGGER, whose observations I have often had occasion to verify, from the numerous materials afforded by the Museum of the Low Countries.

the Camel of the New World, an animal indigenous to the Cordilleras, and which, in a domestic state, gives rise to numerous races, distinguished by a difference of colour, that have been considered as distinct species*: then the Tapir of America, the prehensile-tailed Porcupine, the Armadillo, the Sloth, the Anteater, the Chinchilla, the Nasuas, which I would willingly refer to the same species;† the Cavys, the American Ostrich Rhea, &c. Several other animals are found as far as Mexico, and even in the southern parts of North America; as the Lion of America (Felis concolor), the Jaguar (Felis Onça), in which the length of the tail appears very variable in different individuals; the Skunks, Viverra putorius, and V. mephites,‡ &c. There exist a very few animals which are identical in both Americas, such as the Hare, Lepus Americanus, and L. Braziliensis. Finally, there are some that are represented by others in both Americas, even though belonging to different species; such are the Deer, and several Dogs, the Procyons, the Didelphes, &c. It should be cited as a very remarkable fact, that in a region shrouded in

* My researches on this subject have satisfied me that we must reduce all the varieties of this animal to a single species, the *Red Llama*.

† We never meet with two individuals of the genus Nasua perfectly alike, which prevents me applying, for the determination of the species, any of the characters that naturalists have assigned to the two principal species of this genus; not even those drawn from the skull, the form of which changes with the age. It might be, perhaps, objected that these two species have a different mode of life, an objection which I have often to refute by the simple observation, that many animals, when arrived at a certain age, adopt a different mode of life: the young generally living in society, and undertaking journeys more or less distant; while the old ones isolate themselves in the recesses of deep forests, or of mountainous regions. We may compare these habits to those of birds of passage, among which, it is known, that the young always separate themselves from the adults, on setting out on distant migrations. I beg travelling naturalists to fix their attention on this interesting point in the habits of animals.

‡ All the pretended species of this genus that I have seen appear to belong to a single species, the fur of which is black, varied often by brown, with the white rays more or less broad, according to the individual, or sometimes altogether without the rays, especially in the young, several of which have been transmitted to us under the name of Mustela Leucauchen.

deep forests, and of immense extent, as Brazil, there should exist only a single species of Squirrel, the Sciurus æstuans : this fact is the more remarkable, because we observe a great number of reptiles that constantly live on trees, as the Tree Frogs, the Leguans, the Anolius, &c. ; and because there exist several species of squirrel in North America.* South America produces a very considerable number of aquatic animals, especially in the class of reptiles ; but it is a very remarkable fact, that among the great number of fresh-water Tortoises, there is but one species of Trionyx, which is called by way of eminence the *Water Tortoise*, and of which one species is found in North America. As regards the large mammifera, those of North America are almost all different from those of the southern peninsula of the New World, and often have a great affinity to those of Europe, belonging ordinarily to the same genera. We find there, for example, two species of Bos ; one, the Bison, appears very near the Ursus or European Bison ; Elks and Reindeer are also found there, different, as it seems, from those of Europe ; the Wolves, Canis nubilus and C. latrans, probably only form local varieties of those of Europe : the North American Beaver, on the other hand, has specific differences from ours ; of the three Bears inhabiting America, two, Ursus ferox, and U. Americanus, are peculiar to that peninsula ; the third is the same as the European species. We there find a great number of the family of Spermophili, some of which are very like the species of Europe and Asia. The Marmottes, the common Fox, the common Lynx, and the Glutton of North America, do not differ from those of Europe ; but the Badger of Labrador is very different from ours. The Scalops and the Condylurus there represent our Moles and Musk Rats. The lofty mountains stretching along the western coasts of North

* One species of that country, the Sciurus Capistratus or S. Carolinensis is very remarkable for the numerous varieties which it forms : they are white, black, grey, brown, in short, of all colours. The species appears to inhabit even Mexico : compare them with Sciurus hypoxanthos of LICHTENSTEIN.

America, produce several very curious animals, among which we may mention the Antilope furcifer and Ant. montana. As to reptiles, this vast peninsula affords a very great number of aquatic Tortoises, of the genera Emys and Trionyx; but, except in the southern parts, there are no terrestrial Tortoises, or rather the animal which represents them, is the Emys clausa, a species intermediate between terrestrial and aquatic tortoises. Saurian reptiles occur there in very small number, in comparison to what we observe in South America, and there are none of the species inhabiting trees. The Batrachians, on the contrary, are there very common; and there we find a great quantity of Salamanders,* and those singular Batrachians, which one would take for the larvæ of Salamanders, or for incomplete animals, and which may be compared to our European Proteus; but the Bombintors (Rana Braziliensis, Gmel.) have never yet been observed in North America. In comparing together the species of reptiles, or more especially the serpents of the two peninsulæ forming the new continent, we are able to establish very interesting parallels; the common Frog of North America, Rana mugiens, for example, is represented, in South America, by an analogous species, Rana pachypus, of the same size, but with the toes entirely free. The Toad of the United States, Bufo musicus, which also inhabits several of the Antilles, is not found in South America, where it is replaced by the Bufo aqua. The Crotalus horridus, common in all South America, is represented, in North America, by the Crotalus durissus; the Coronella venustissima is there represented by the Cor. coccinea, the Emys scorpioides by the Emys odorata, &c. The comparison, however, which we have made between the reptiles of the two Americas only applies to a small number of species, and it often happens that one of the two peninsulæ produce species, or even genera, of which no representative exists in the other.† The Tortrix, the Dipsas, the Den-

* The Salamanders peculiar to the temperate regions of the northern hemisphere, and the Cæcilia, a native of tropical regions, would appear to replace each other in these two zones.

† The Ophisaurus, which there represents our Pseudopus, and of

drophis, the Boa, have hitherto not been found, except in South America, and the Antilles; the Tropidonoti, on the contrary, are never found there, but are common in North America, and are also diffused in several of the Antilles. A small number of species of serpents of South America have also been observed in North America; these are as follow: Calamaria melanocephala, Lycodon Clelia, Coronella cobella, Herpetodryas cursor, Dryiophis Catesbyi, Elaps corallinus, Homalopsis carinicauda. The Heterodon platyrhinus, and the Herpetodryas æstivus, on the contrary, which are common in North America, have also been discovered in Brazil.* The following species inhabit both North America and the Antilles: Calamaria striatula, Coronella coccinea, Heterodon platyrhinus, Coluber constrictor, Herpetodryas æstivus, and H. cursor, Tropidonotus bipunctatus, T. fasciatus, and T. saurita. The following are also found in the Antilles, though their mother country is south America: Calamaria melanocephala, Coronella reginæ, Lycodon clelia, Dendrophis liocercus, Dryiophis Catesbyi, and D. aurata, Dipsas annulata, Homalopsis angulata, Boa constrictor, B. cenchria, and Elaps corallinus. There remain, then, but about four species which are peculiar to the great archipelago of which we speak, namely, Psammophis Antillensis, Trigonocephalus lanceolatus, Dendrophis Catesbyi, and Boa melanura. In comparing the serpents of Guyana with those of Brazil, we find that these two countries have a great number of species in common, of which several form local varieties more or less distinct, as is observed in the Herpetodryas lineatus, and H. Olfersii, the Coluber poecilostoma, &c. Several other species appear peculiar to one or other of those countries; as for example, Calamaria badia, Xenodon typhlus, Coluber

which the colours are very subject to variation, so that they have been divided into several species, is peculiar to North America. The genera of reptiles peculiar to South America are more numerous; of those we may cite the Bombinators, the Lizards or Centropyx, the Ceratophrys, the Cæcilia, the Amphisbæna, &c. Several of these animals are found also in the Antilles.

* It may be remarked, that the Heterodon platyrhinus and Homalopsis carinicauda form local varieties in these two distant places.

Corais, Herpetodryas Boddaertii, Dendrophis aurata, Dryiophis Catesbyi, and D. argentea, Homalopsis plicatilis, Elaps lemniscatus, and E. Surinamensis, &c., which have been observed in the Guyanas, where the following natives of Brazil are wholly wanting : Calamaria Blumii, Coronella Merremii, Xenodon Schotii, and X. rhinostoma, Lycodon formosus, Herpetodryas serra, Homalopsis carinicauda, and H. Martii, &c. Others appear to be represented in those two points of South America, so that we may place the Coronella venustissima, Dipsas Mikani, D. Wiegeli, D. leucocephala, and D. Nattereri, with the Trigonocephalus Jacaraca, all of Brazil, in parallels with the Coronella venusta, Dipsas nebulata, D. Catesbyi, D. macrorhina, D. punctatissima, and the Trigonocephalus atrox of the Guyanas. The other parts of South America are too little known to enable us to establish a comparison between the reptiles of the different countries of that continent ; it is however, proper to remark, that there have been discovered in Chile several new serpents, which do not appear to exist on the other side of the Cordilleras.

I must conclude this review of the geographical distribution of serpents, fearing that I have already abused the patience of the reader, by entering into details which I might have here omitted, and which I purpose to treat of more at large in another work, which has occupied me for a long time past.

In conclusion, I regret not to be able to add, as a sequel to this book, some observations on *Fossil Serpents*. To this time we have not discovered more than the remains of a very small number ;* and these remains, confined almost wholly to a few vertebræ, often accompanied by ribs, or at most to some isolated fragments of the cranium, are too incomplete to serve for the exact determination of the genera, or the families to which these beings have pertained. The few observations made on fossil serpents appear, in-

* Consult the labours of MORREN ; also of CUVIER, *Ossem. Fossil.*, iv, p. 180, and v. p. 2, p. 168 ; GOLDFUSS, *Nova Acta*, XV. p. 1, pl. 3, fig. 8. &c.

deed, to favour the opinion that those animals were not numerous in antediluvian epochs, and that they did not exist at that remote period when the earth was inhabited by those Saurians of enormous magnitude, those singular animals known by the names of Plesiosaurus and Ichthyosaurus, reptiles of which such fine remains are discovered in the Juracic and chalk formations.

SCHLEGEL'S

ARRANGEMENT OF SERPENTS.

Division I.—INNOCUOUS SPECIES.

Family 1st.—BURROWING SERPENTS.

Genus I.—Tortrix.

Sp. 1. Tortrix scytale, ... South America
... 2. ..... rufa, ... Java, &c.
... 3. .... maculata, ... Ceylon
... 4. ..... Eryx,..... Asia
... 5. ..... pseud-eryx..... Australia
... 6. ..... xenopeltis,..... Java, &c.
... 7. .... Boa, ... New Ireland

Fam. 2d.—VERMIFORM SERPENTS.

Gen. Calamaria.

Sp. 1. Calamaria lumbricoidea,..... Java, &c.
... 2. ..... Linnæi, ... Java
... 3. ..... Orbignyi, ... Chile
... 4. ..... amœna, ... North America
... 5. ..... diadema,..... Australia
... 6. ..... brachyorrhos,..... ..... Java, &c.
... 7. ..... badia, ... Cayenne
... 8. ..... arctiventris, ... Cape of Good Hope
... 9. .. .. melanocephala, ... America
... 10. ..... punctata, ... North America

Sp. 11.	Calamaria oligodon, ...	Java, &c.
... 12.	.... scytale, ...	Philippines, Ceylon
... 13.	..... striatula, ...	Martinique
... 14.	..... elapsoides, ...	Java
... 15.	..... Blumii, ...	South America
... 16.	..... coronata, ...	Coast of Guinea
... 17.	..... atrocincta, ...	Chile
... 18.	..... Coronella, ...	?

Fam. 3d.—TERRESTRIAL SERPENTS.

Gen. I.—Coronella.

Sp. 1.	Coronella venustissima, ...	South America
... 2.	..... coccinea, ...	North America
... 3.	..... Merremmii, ...	Brazil
... 4.	..... Regina, ...	Guyana, &c.
... 5.	..... Cobella, ...	America
... 6.	..... baliodeira, ...	Malayan Asia
... 7.	..... lævis, ...	Europe
... 8.	..... Chilensis, ...	Chile
... 9.	..... rhombeata, ...	Cape of Good Hope
... 10.	..... rufescens, ...	Cape of Good Hope
... 11.	..... rufula, ...	Cape of Good Hope
... 12.	..... Aurora, ...	Cape of Good Hope
... 13.	..... octolineata, ...	Java, &c.
... 14.	..... Russeli, ...	Bengal

Gen. II.—Xenodon.

Sp. 1.	Xenodon severus, ...	South America
... 2.	..... rhabdocephalus, ...	Brazil
... 3.	..... inornatus, ...	Java
... 4.	..... purpurascens, ...	Java
... 5.	..... Schottii, ...	Brazil
... 6.	..... Michahellis, ...	Southern Europe
... 7.	..... typhlos, ...	Guyana
... 8.	..... bicinctus, ...	Brazil

Gen. III.—Heterodon.

Sp. 1.	Heterodon platyrhinus, ...	North America
... 2.	..... rhinostoma, ...	Brazil
... 3.	..... coccineus, ...	Mexico

Gen. IV.—Lycodon.

Sp. 1.	Lycodon Hebe, ...	India, &c.
... 2.	..... carinatus, ...	Ceylon

Sp. 3. Lycodon Jara, ... India
... 4. .... geometricus, ... ?
... 5. ... . Horstokii, ... Gold Coast, Cape of G. H.
... 6. ..... unicolor, ... Guinea
... 7. ..... formosus, ... Brazil
... 8. ..... Clelia, ... South America
... 9. ..... subcinctus,..... ..... Bengal, Java
... 10. ..... modestus, ... Amboina, &c.
... 11. ..... Nympha, ... Bengal
... 12. ..... audax, ... Paraguay
... 13. ..... petolarius, ... Guyana

Gen. V.—Coluber.

Sp. 1. Coluber Æsculapii,..... Southern Europe
... 2. ..... constrictor, ... North America
... 3. ..... radiatus,..... Cochin-China, &c.
... 4. ..... subradiatus, ... Timor
... 5. ..... Blumenbachii, ... India
... 6. ..... korros, ... Java, &c.
... 7. ..... corais,..... Surinam
... 8. ..... melanurus,..... Java
... 9. ..... panthorinus, ... Brazil
... 10. ..... virgatus, ... Japan
... 11. ..... quadrivirgatus, ... Japan
... 12. ..... diadema,..... India
... 13. ..... miniatus, ... Isle of France
... 14. ..... variabilis, ... South America
... 15. ..... plumbeus, ... South America
... 16. ..... poëcilostoma,..... Surinam
... 17. ..... canus,..... Southern Africa
... 18. ..... Sayi, ... Missouri
.. 19. ..... quadriradiatus, ... Southern Europe
... 20. ..... viridiflavus, ... Southern Europe
... 21. ..... Cliffordii, ... Northern Africa
... 22. ..... hippocrepis, ... Shores of Mediterranean
... 23. ..... florulentus,..... Egypt
... 24. ..... trabalis, ... Tartary
... 25. ..... guttatus,..... N. America
... 26. ..... leopardinus, ... Southern Europe, &c.
... 27. ..... conspillatus, ... Japan

Gen. VI.—Herpetodryas.

Sp. 1. Herpetodryas carinatus, ... South America
... 2. ..... serra, ... Brazil
... 3. ..... viridissimus, ... Surinam
... 4. ..... Olfersii, ... Surinam and Brazil
... 5. ..... margaritiferus, ... New Orleans
... 6. .... Boddaertii,..... ... Surinam

Sp. 7.	Herpetodryas	æstivus,	America
... 8.	.....	tricolor,	Java
... 9.	....	Goudotii,	Madagascar
... 10.	....	oxycephalus,	Java, &c.
... 11.	.....	lineatus,	South America
... 12.	.....	Helena,	Bengal
... 13.	.....	rhodogaster,	Madagascar
... 14.	.....	geminatus,	Java
... 15.	.....	Psammophis,	New Orleans
... 16.	.....	Dendrophis,	Cayenne
... 17.	.....	Dipsas, ...	Celebes
... 18.	.....	getulus,	North America
... 19.	.....	cursor,	America

Gen. VII.—Psammophis.

Sp. 1.	Psammophis	lacertina,	Shores of Mediterranean
... 2.	.....	moniliger,	Africa
... 3.	.....	pulverulenta,	India, &c.
... 4.	.....	Seychellensis,	Seychelles, &c.
... 5.	.....	Antillensis, ...	West Indies
... 6.	.....	Dahlii,	Dalmatia
... 7.	.....	elegans,	Western Africa
.. 8.	.....	Temminckii,	Chile

Fam. 4th.—TREE-SNAKES.

Genus I.—Dendrophis.

Sp. 1.	Dendrophis	liocerus,	South America
... 2.	.....	Catesbyi,	Hayti
... 3.	.....	aurata,	Surinam
... 4.	.....	picta,	Africa, Asia
... 5.	.....	formosa,	Sumatra, &c.
... 6.	.....	rhodopleuron,	Amboina
... 7.	.....	ornata,	India, &c.
... 8.	.....	præornata, ...	Senegal
... 9.	.....	smaragdina,	Gold Coast
... 10.	.....	colubrina,	Cape of Good Hope

Gen. II.—Dryiophis.

A. *of the Ancient World.*

Sp. 1.	Dryiophis	nasuta,	India, &c.
... 2.	.....	Langaha,	Madagascar
... 3.	.....	prasina,	India, &c.

B. *of the New World.*

Sp. 5. Dryiophis Catesbyi,..... Cayenne, &c.
... 6. ..... argentea,..... Cayenne, &c.
... 7. ..... aurata,..... America

GEN. III.—DIPSAS.

Sp. 1. Dipsas dendrophila,..... Java, &c.
... 2. ..... multimaculata, ... Bengal, &c.
... 3. ..... trigonata,..... Bengal
... 4. ..... cynodon, ... Sumatra, &c.
... 5. ..... Drapiezi, ... Sumatra, &c.
... 6. ..... irregularis, ... Celebes, &c.
... 7. ..... colubrina,..... ..... Madagascar
... 8. ..... Egyptiaca, ... Africa
... 9. ..... nebulata, ... Surinam
... 10. ..... Mikanii, ... Brazil
... 11. ..... Weigeli, ... Brazil
... 12. ..... Catesbyi, ... Guyana
... 13. ..... pavonia, ... Guyana
... 14. ..... bucephala, ... Sumatra
... 15. ..... Dieperinki, ... Surinam
... 16. ..... Boa, ... Java
... 17. ..... carinata, ... Java
... 18. ..... lævis, ... Java
... 19. ..... leucocephala, ... Brazil
... 20. ..... macrorhina, ... Guyana
... 21. ..... Nattereri,..... Brazil
... 22. ..... punctatissima, ... South America
... 23. ..... Daimardi,..... Madagascar
... 24. ..... annulata, ... South America, &c.
... 25. ..... fallax, ... Dalmatia, &c.

FAM. 5TH.—FRESH-WATER SERPENTS.

GENUS I.—TROPIDONOTUS.

Sp. 1. Tropidonotus natrix, ... Europe
... 2. ..... quincunciatus, ... India
... 3. ..... umbratus, ... India
... 4. ..... rhodomelas, ... Java
... 5. ..... trianguligerus, ... Java
... 6. ..... chrysargos, ... Celebes
... 7. ..... subminiatus, ... Java
... 8. .... picturatus,..... New Guinea
... 9. ..... tigrinus, ... Japan
... 10. ..... Vibakari, ... Japan
... 11. ..... stolatus,..... India, &c.
... 12. ..... vittatus, ... Java

Sp. 13. Tropidonotus schistosus, ... India, &c.
... 14. ..... bipunctatus, ... Central America
... 15. ..... saurita, ... North America
... 16. ..... fasciatus, ... North America
... 17. ..... viperinus, ... Southern Europe, &c.
... 18. ..... scaber, ... Cape of Good Hope
... 19. ..... mortuarius, ... Bengal

Gen. II.—Homalopsis.

Sp. 1. Homalopsis buccata, ... Java
... 2. ..... Schneideri, ... India, &c.
... 3. ..... decussata,... ..... Java
... 4. ..... leucobalia, ... Timor
... 5. ..... plumbea, ... Java
... 6. ..... Aer, ... India
... 7. ..... Sieboldii,..... India
... 8. ..... carinicauda, ... America
... 9. ..... angulata, ... South America
... 10. ..... plicatilis, ... Brazil, New Orleans
... 11. ..... Martii,..... South America
... 12. ..... Reinwardtii, ... Louisiana
... 13. ..... leopardina, ... ?
... 14. ..... Herpeton, ... ?

Fam. VI.—BOAFORM SERPENTS.

Gen. I.—Boa.

Sp. 1. Boa constrictor, ... South America
... 2. ... murina, ... South America
... 3. ... cenchria, ... South America
... 4. ... canina, ... South America
... 5. ... hortulana, ... South America
... 6. ... Dussumieri, ... Mauritius
... 7. ... carinata, ... Moluccas
... 8. ... conica, ... Bengal
... 9. ... melanura, ... Cuba

Gen. II.—Python.

Sp. 1. Python bivittatus, ... Africa, Asia
... 2. ..... Schneideri, ... Malacca, &c.
... 3. ..... amethystinus, ... Amboina, &c.
... 4. ..... Peronii, ... Australia

Gen. III.—Acrochordus.

Sp. 1. Acrochordus Javanicus, ... Java
... 2. ..... fasciatus, ... India, &c.

Div. II.—VENOMOUS SERPENTS.

Family 1st.—COLUBRIFORM VENOMOUS SERPENTS

Genus I.—Elaps.

A. *American Species.*

Sp. 1. Elaps corallinus, ... Central America
... 2. ..... lemniscatus, ... Guyana
... 3. ..... Surinamensis,..... Guyana
... 4. ..... Jamesoni, ... South America

B. *African Species.*

... 5. ..... Hygeiæ, ... Cape of Good Hope

C. *Asiatic Species.*

... 6. ..... collaris, ... Indian Islands
... 7. ..... trimaculatus, ... India
... 8. ..... furcatus,..... Java, &c.
... 9. ..... bivirgatus,..... Java, &c.

D. *Australian Species.*

...10. ..... Mülleri,..... New Guinea
...11. ... .. coronatus, ... Australia
...12. ..... Psammophis, ... Australia

Gen. II.—Bungarus.

Sp. 1. Bungarus annularis, ... India
... 2. .... semifasciatus, ... India

Gen. III.—Naja.

Sp. 1. Naja tripudians, ... India
... 2. ..... Haje, ... Egypt, and Africa
... 3. ..... Bungarus, ... Java, &c.
... 4. ..... bungaroides, ... Java, &c.
... 5. ..... porphyrica,..... Australia
... 6. ..... hæmachates, ... Cape of Good Hope
... 7. ..... rhombeata,..... Cape, and Gold Coast
... 8. ..... lubrica, ... Cape of Good Hope
... 9. ..... Elaps,..... ?
...10. ..... curta, ... Australia

Fam. 2d.—SEA-SERPENTS.

Gen. I.—Hydrophis.

Sp. 1. Hydrophis schistosa, ... Gulf of Bengal
... 2. ..... striata, ... Indian Seas
... 3. ..... nigrocincta, ... Gulf of Bengal
... 4. ..... gracilis, ... Indian Seas
... 5. ..... Pelamys, ... Indian Seas
... 6. ..... pelamoides, ... Indian Seas
... 7. ..... colubrina, ... Indian Seas

Fam. 3d.—VENOMOUS SERPENTS, PROPERLY SO CALLED.

Gen. I.—Trigonocephalus.

A. *Head covered by Scales.*

Sp. 1. Trigonocephalus Jacaraca, ... Brazil
... 2. ..... atrox, ... Guyana
... 3. ..... lanceolatus, ... Antilles
... 4. ..... bilineatus, ... South America
... 5. ..... nigromaculatus, ... Ceylon
... 6. ..... Wagleri, ... Sumatra
... 7. ..... viridis, ... Sumatra, Celebes
... 8. ..... puniceus, ... Java

B. *With Plates on the Head.*

... 9. ..... rhodostoma, ... Java
... 10. ..... hypnale, ... Ceylon, &c.
... 11. ..... Halys, ... Tartary
... 12. ..... Blomhoffii, ... Japan
... 13. ..... cenchris, ... North America

Gen. II.—Crotalus.

Sp. 1. Crotalus horridus, ... South America
... 2. ..... durissus, ... North America
... 3. ..... miliarius, ... North America
... 4. ..... mutus, ... South Americ

Gen. III.—Vipera.

Sp. 1. Vipera arietans, ... Africa
... 2. ..... atropos, ... Cape of Good Hope
... 3. ..... cornuta, ... Cape of Good Hope
... 4. ..... Echis, ... India

Sp. 5.	Vipera cerastes, ...	Northern Africa
... 6.	..... elegans, ...	India
.. 7.	..... berus, ...	North and Central Europe
... 8.	..... aspis, ...	Southern Europe
... 9.	..... ammodytes, ...	Greece, &c.
... 10.	..... acanthophis, ...	Australia

EXPLANATION OF THE PLATES.

A B, *Head of* Herpetodryas carinatus, *shewing the designations of the large Scales or Plates that cover the heads of Serpents.*

A, Upper Surface.

a Vertical
b Occipitals
c Superciliars
d Temporals
e Posterior frontals
f Anterior frontals
g Rostral
h Posterior oculars
j Anterior oculars
k Frenal

B, Under Surface.

l Nasal
m Marginal labials
n Middle labial
o Accessory labials
p Anterior geneials
q Posterior geneials
r Marginal labials
s Gular scales
t Gular scuta
u Abdominal scuta

Innocuous Snakes.

Fig. 1. Tortrix Xenopeltis
2. Calamaria lumbricoidea
3. Coronella Cobella
4. Xenodon inornatus
5. Heterodon rhinostoma
6. Lycodon Hebe
7. Coluber constrictor
8. Herpetodryas carinatus
9. Psammophis lacertina
10. Dendrophis formosa
11. Dryiophis Catesbyi
12. Dipsas cynodon
13. Tropidonotus trianguligerus

Fig. 14. Homalopsis Martii
15. Boa canina
16. Acrochordus fasciatus
17. Python Schneideri

Venomous Snakes.

18. Elaps Surinamensis
19. } Elaps Jamesoni
20. }
21. Bungarus semifasciatus
22. Naja tripudians
23. Hydrophis schistosa
24. Trigonocephalus atrox
25. Crotalus Durissus
26. Vipera elegans

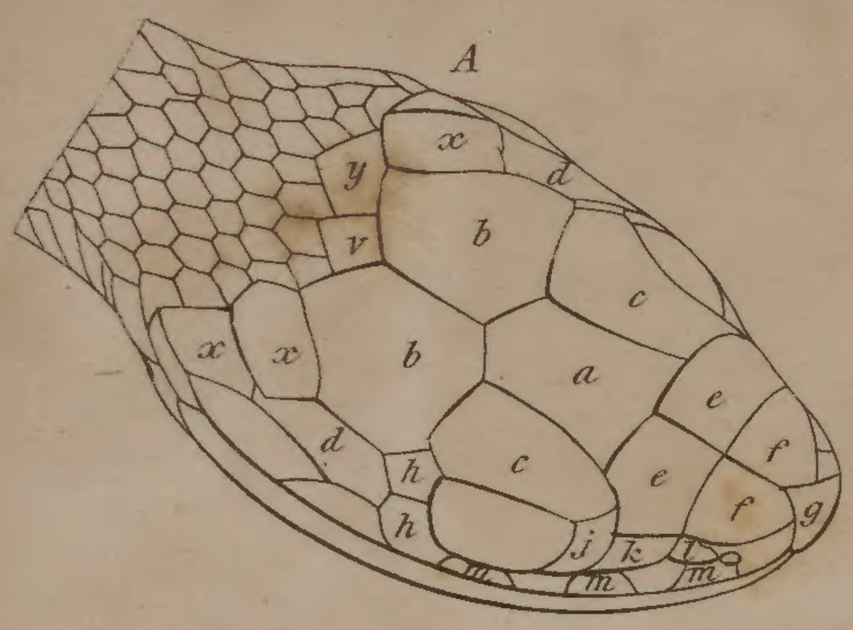
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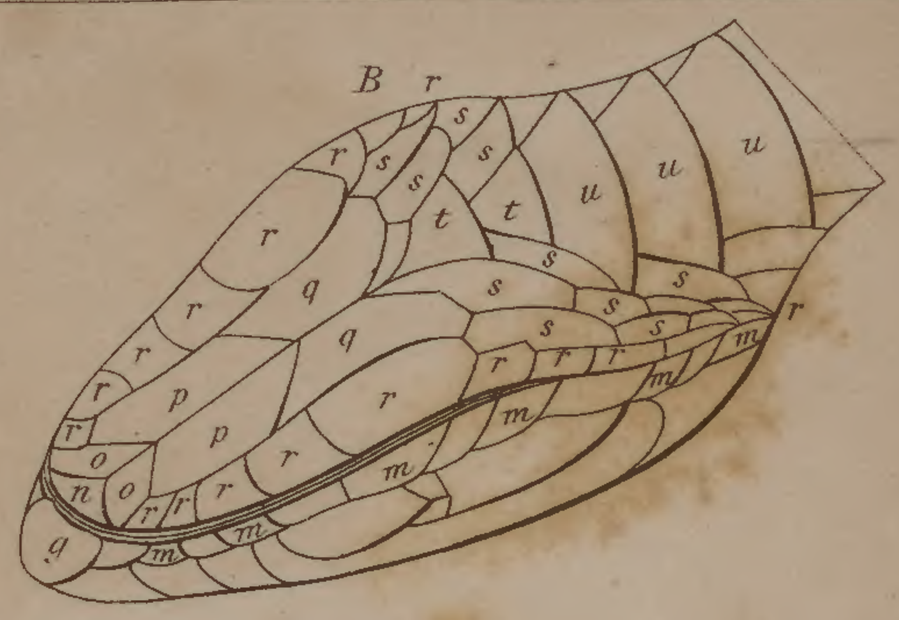
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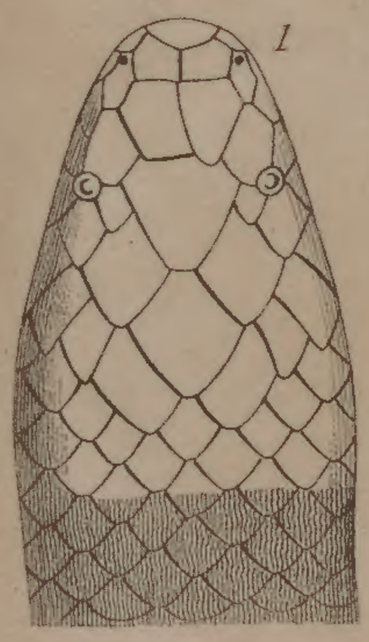
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...	...	...	26,	... their	... the
...	109,	note,		... Sehlangen	... Schlangen,
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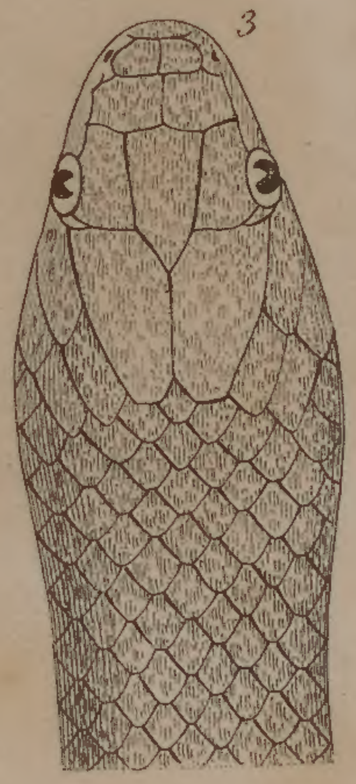
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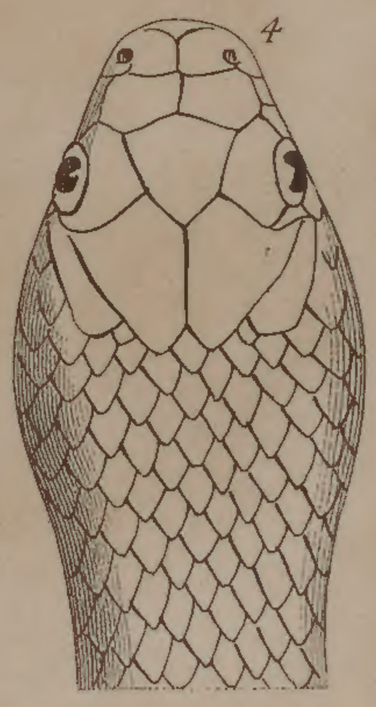


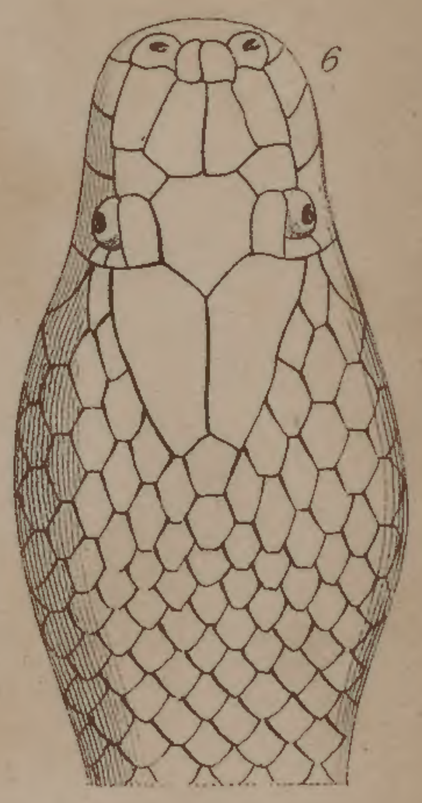




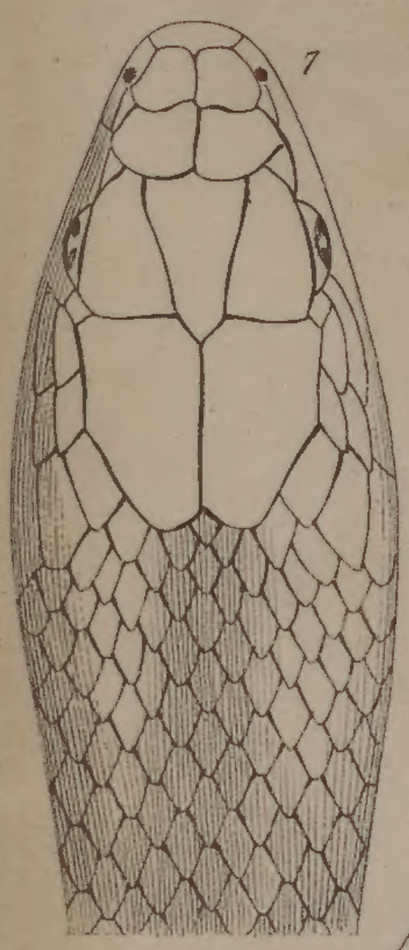


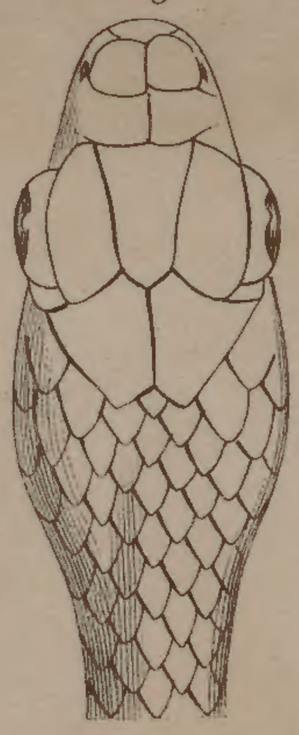




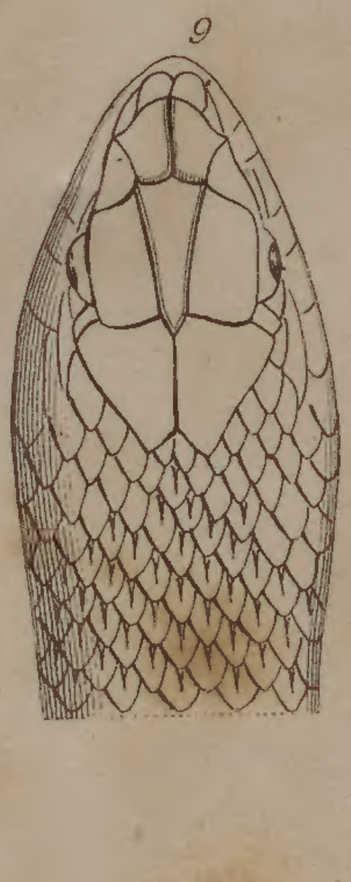


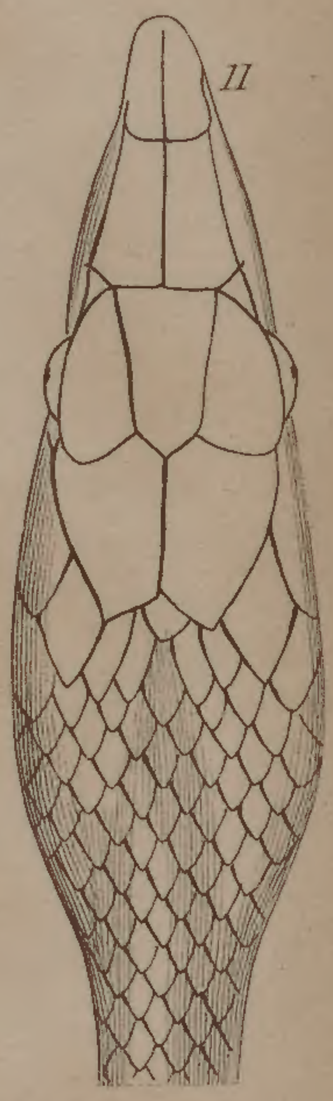


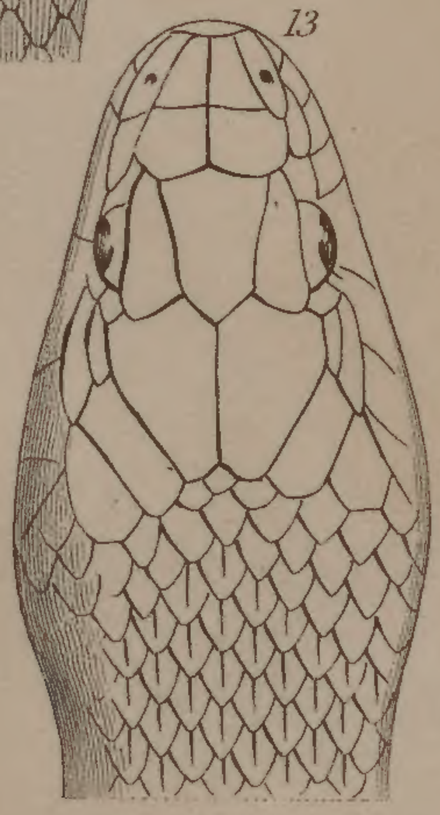


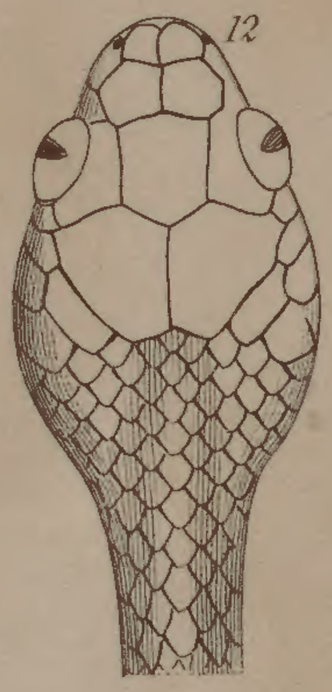










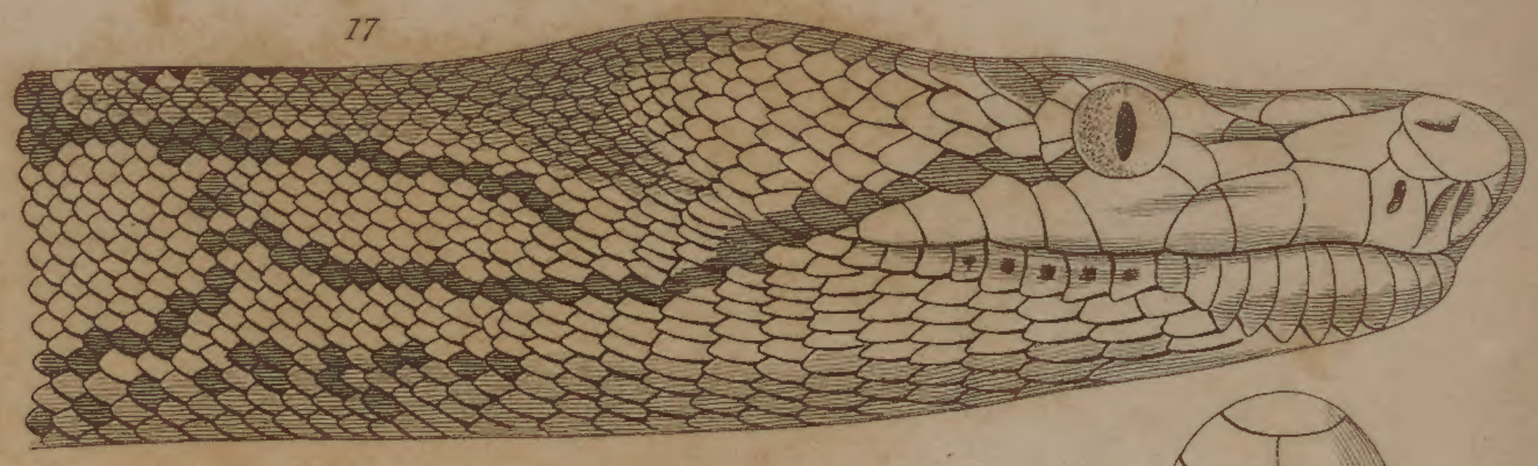




W.H.Lizars sc.

PLATE II.

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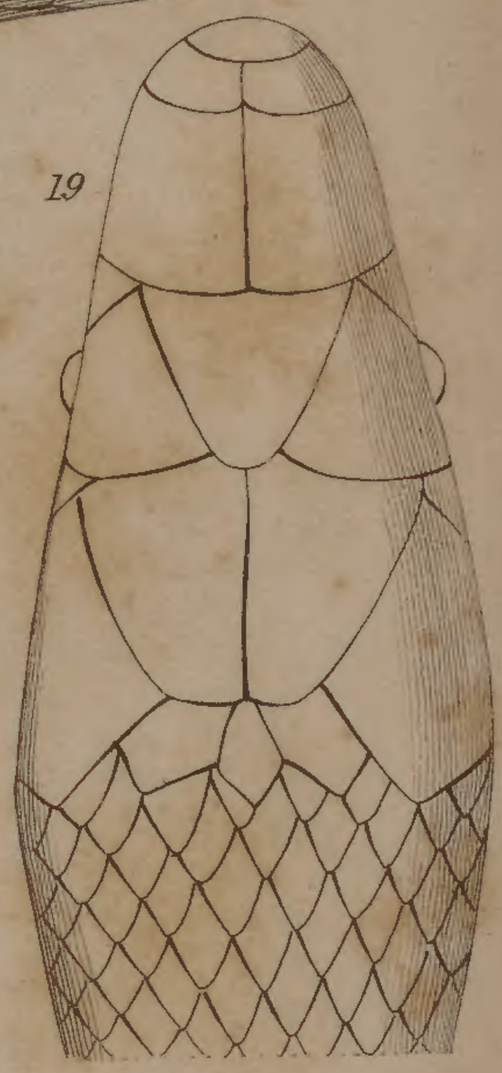
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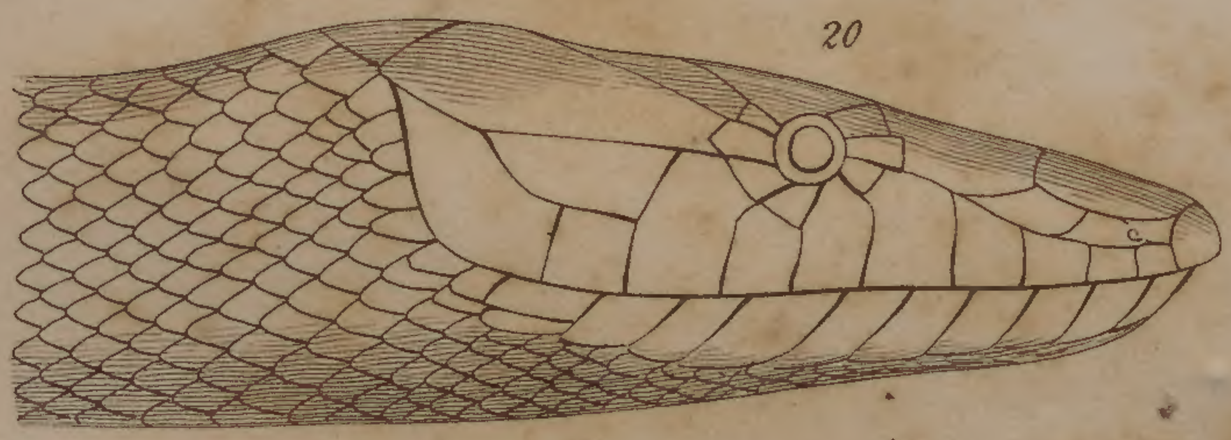
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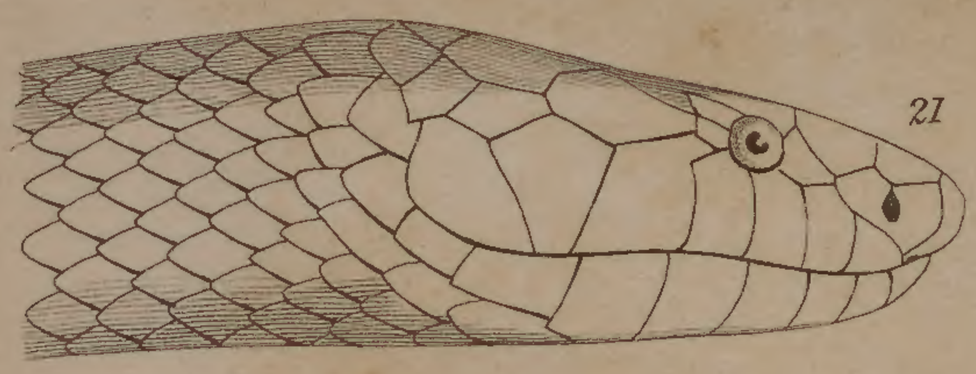
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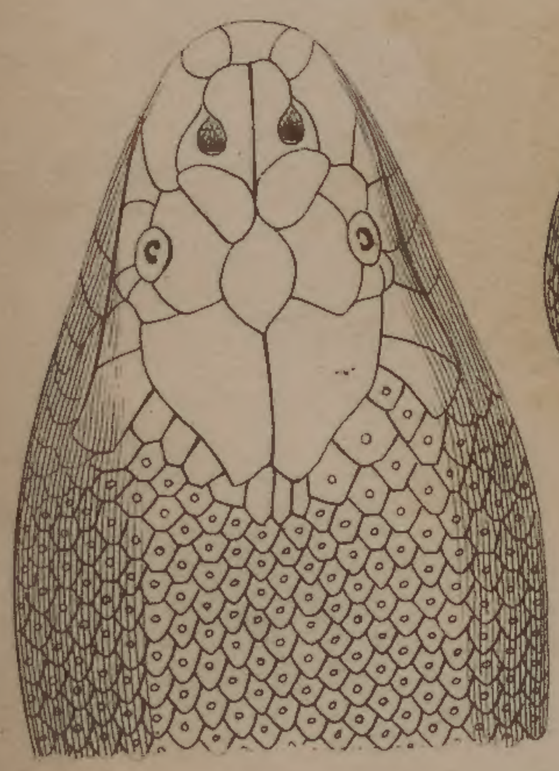
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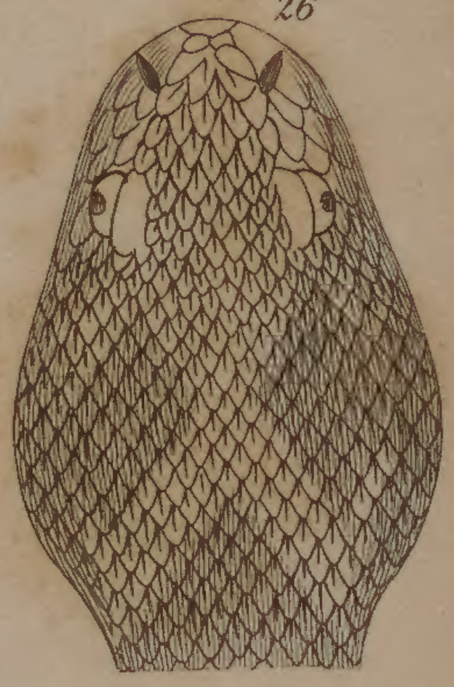
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